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Final

Feasibility Study
Operable Unit 14, Site 90

Marine Corps Air Station
Cherry Point, North Carolina

Contract Task Order 0192

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Acronyms and Abbreviations

[#]CFR [#]	Title "#" of the Code of Federal Regulations, Part or Section "#"
AA	Attainment Area
AA1	Attainment Area No. 1
AA2	Attainment Area No. 2
AFCEE	Air Force Center for Environmental Excellence
ARAR	Applicable or Relevant and Appropriate Requirement
AS	air sparge / air sparging
AWQC	Ambient Water Quality Criteria
bgs	below ground surface
BRAC	Base Realignment and Closure
BTEX	benzene, toluene, ethylbenzene, and xylenes
CAP	Corrective Action Plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
cm/s	centimeter per second
COC	Chemical of Concern
COPC	Chemical of Potential Concern
COPEC	Contaminant of Potential Ecological Concern
CSM	conceptual site model
CVOC	chlorinated volatile organic compounds
DCA	dichloroethane
DCE	dichloroethene
DNAPL	dense non-aqueous phase liquid
DO	dissolved oxygen
DPT	direct push technology
EAD	Environmental Affairs Department
EPA	Environmental Protection Agency
ERA	ecological risk assessment
ERD	Enhanced Reductive Dechlorination
ERP	Environmental Restoration Program
ESV	Ecological Screening Value
FFA	Federal Facility Agreement
FP	free product
FRCE	Fleet Readiness Center - East
FS	Feasibility Study
ft	foot or feet
GRA	General Response Action

HDD	horizontal directionally drilled
HDPE	high density polyethylene
HF	hydraulic fracturing
HHRA	human health risk assessment
HNUS	Halliburton NUS
HI	hazard index
IAS	initial assessment study
IDW	investigation-derived waste
IRP	Installation Restoration Program
ISCO	In Situ Chemical Oxidation
ISCR	In Situ Chemical Reduction
IWTP	Industrial Wastewater Treatment Plant
Jones	J.A. Jones Environmental Services Company
K_h	horizontal hydraulic conductivity
LUC	Land-Use Control
M	million
MCAS	Marine Corps Air Station
MCL	Maximum Contaminant Level
MEE	methane, ethane, and ethene
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MNA	Monitored Natural Attenuation
msl	mean sea level
MTBE	methyl-tert-butyl ether
mV	millivolts
NACIP	Navy Assessment and Control of Installation Pollutants
NADEP	Naval Aviation Depot (now called Fleet Readiness Center-East [FRCE])
NAVFAC	Naval Facilities Engineering Command
Navy	U.S. Department of the Navy
NC	North Carolina
NCAC	North Carolina Administrative Code
NC2B	Surface Water Quality and Wetland Standards as defined in NCAC Title 15A, Subchapter 2B
NC2L	Groundwater Standards as defined in NCAC Title 15A, Subchapter 2L
NCDENR	North Carolina Department of Environment and Natural Resources
NCP	National Contingency Plan
NEBA	Net Environmental Benefits Analysis
NPL	National Priorities List
O&M	operation and maintenance
ORP	oxidation-reduction potential
OU	Operable Unit

PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PF	pneumatic fracturing
POL	petroleum, oil, and lubricant
PRAP	Proposed Remedial Action Plan
PRG	Preliminary Remediation Goal
PV	present value
R	retardation coefficient
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RGO	Remedial Goal Option
RI	Remedial Investigation
ROD	Record of Decision
ROI	radius of injection
SARA	Superfund Amendments and Reauthorization Act
SSL	soil screening level
SVE	soil vapor extraction
TBC	to be considered
TCE	trichloroethene
TCR	target cancer risk
TEAP	Terminal Electron Accepting Process
TOC	total organic carbon
TRZ	Target Remediation Zone
TTNUS	TetraTech NUS, Inc.
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
UST	underground storage tank
VC	vinyl chloride
VOC	volatile organic compound

SECTION 1

Introduction

This Feasibility Study (FS) report presents an evaluation of remedial alternatives to mitigate unacceptable human health risks associated with contaminants of concern (COC) in groundwater at Operable Unit 14 (OU14) located within Marine Corps Air Station (MCAS) Cherry Point, North Carolina (NC) (Figures 1-1 and 1-2).

This report was prepared under the U.S. Department of the Navy (Navy), Naval Facilities Engineering Command (NAVFAC) Atlantic Division, Comprehensive Long-Term Environmental Action Navy (CLEAN) III Contract N62470-02-D-3052, Contract Task Order 0192, for submittal to NAVFAC Mid-Atlantic, MCAS Cherry Point Environmental Affairs Department (EAD), U.S. Environmental Protection Agency (USEPA) Region 4, and NC Department of Environment and Natural Resources (NCDENR). The Navy, MCAS Cherry Point, USEPA, and NCDENR work jointly as the MCAS Cherry Point Tier I Partnering Team (referred to herein as the Partnering Team).

The FS was developed in accordance with Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requirements, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and implemented by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP);[1] USEPA's (1988) FS guidance, and other relevant USEPA guidance. Consistent with the CERCLA process, this FS will support the selection of a preferred remedy. Subsequent to the selection of the preferred remedy, the Proposed Remedial Action Plan (PRAP) will be prepared followed by the Record of Decision (ROD).

A comprehensive summary of historical activities and investigations at OU14 is provided in the OU14 Remedial Investigation (RI) report finalized in November 2008 (CH2M HILL, 2008).

1.1 Objectives and Approach

The OU14 RI included an evaluation of groundwater, soil, indoor air vapor, sediment, and surface water data, as well as a human health risk assessment (HHRA) and an ecological risk assessment (ERA). No ecological risks were determined by the ERA. No human health risks were determined for exposure to soil, sediment, or surface water; however, potential unacceptable human health risks were determined for exposure to Surficial Aquifer groundwater[2] and indoor air vapor (i.e., vapor potentially emanating from volatile organic compounds [VOCs] in groundwater).

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[1] The NCP is detailed in Title 40 of the Code of Federal Regulations (40CFR), Part 300 (40CFR 300).

[2] Refer to Section 2.2.2 for discussion of geologic and hydrogeologic features at OU14. Surficial Aquifer refers to the unconfined aquifer above the Yorktown Confining Unit and confined Yorktown Aquifer.

The FS uses the conceptual site model (CSM) generated during the RI to develop remedial action objectives (RAOs), preliminary remediation goals (PRGs) (remediation goals, or cleanup levels, are finalized in the ROD), and an evaluation of remedial alternatives. A list of CERCLA COCs compiled for groundwater (Section 2.2.7) is based on the results of the HHRA for OU14 and/or exceedances of NC2L Groundwater Standards (referred to herein as NC2Ls).[3] This report discusses criteria used to evaluate remedial alternatives and to determine the benefits of implementing them.

Pursuant to the EPA (1988) FS guidance, the remedial alternatives are evaluated according to their ability to meet the following evaluation criteria:

1. Overall protection of human health and the environment
2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)
3. Long-term effectiveness and permanence
4. Reduction of toxicity, mobility, or volume
5. Short-term effectiveness
6. Implementability
7. Cost
8. State acceptance
9. Community acceptance

State acceptance and community acceptance are evaluated after regulatory and public comment on the FS and the PRAP. Sustainability elements (e.g., green remediation[4]) may also be considered during evaluation of the remedial alternatives (Section 4.2).

The information presented herein will be used by the Partnering Team to select remedial alternative(s) that comply with the requirements of the NCP. This FS report is not intended to serve as a design document; rather, it gives a conceptual overview of remedial alternatives and an assessment of their feasibility.

1.2 Report Organization

This FS was prepared under the CERLCA format using Federal guidelines, and is organized as follows:

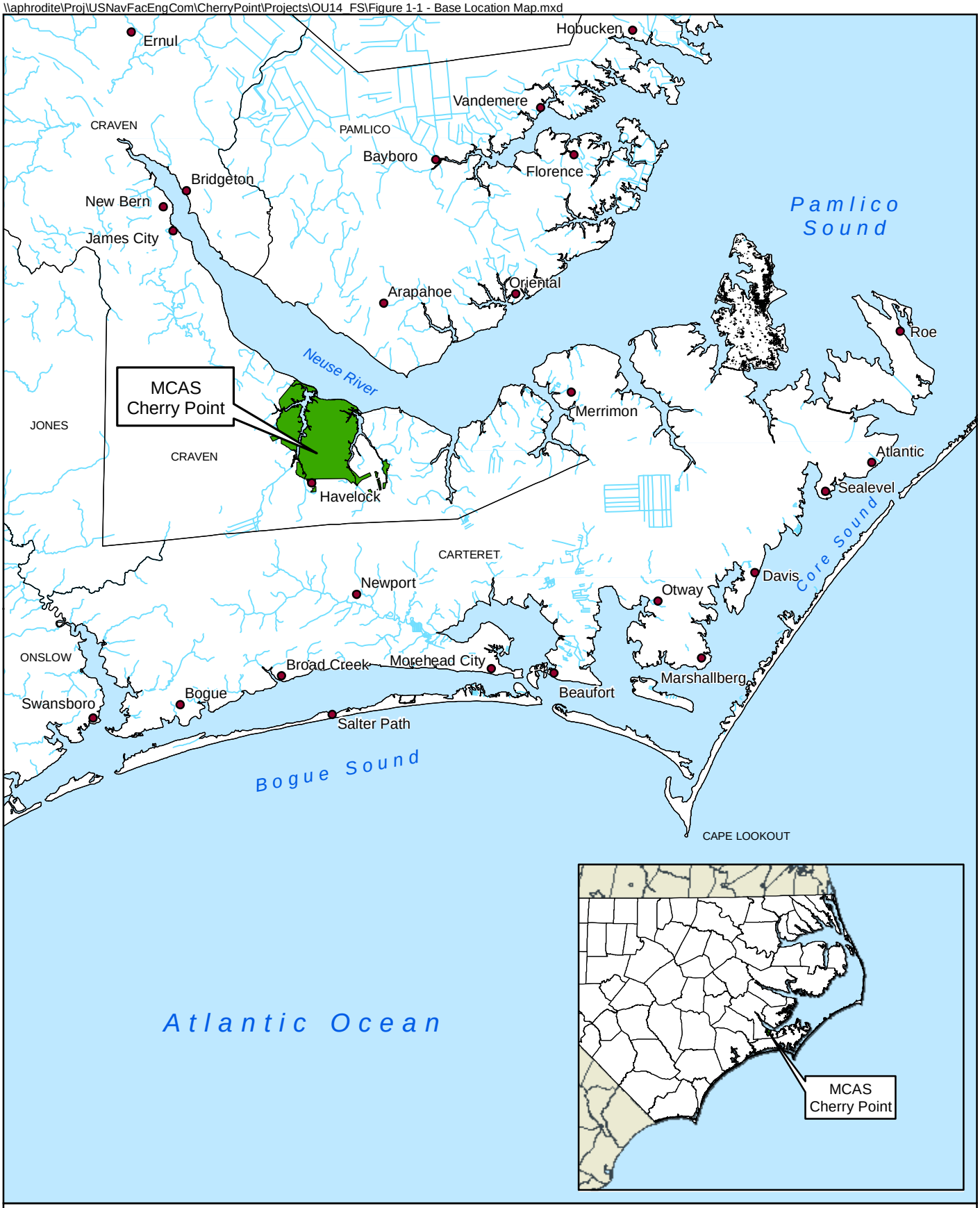
- Section 1 – Introduction
- Section 2 – Site History and Characterization
- Section 3 – ARARs, RAOs, and PRGs
- Section 4 – Identification and Screening of Remedial Technologies and Alternatives
- Section 5 – Development of Remedial Alternatives
- Section 6 – Detailed and Comparative Analysis of Alternatives
- Section 7 – References

[3] NC2L refers to Class GA groundwater quality criteria as defined in the North Carolina Administrative Code, Title 15A, Chapter 2, Subchapter 2L.

[4] Green remediation is the practice of considering all environmental effects of remedy implementation and incorporating options to maximize net environmental benefit of cleanup actions (USEPA, 2008a).

Tables and figures are provided at the end of each respective section. Appendixes are provided electronically on the enclosed CD-ROM.

\\aphrodite\Proj\USNavFacEngCom\CherryPoint\Projects\OU14_FS\Figure 1-1 - Base Location Map.mxd



Legend

- Cities
- Rivers and Streams
- Military Installation
- County Boundary

N
W E
S

0 20,000 40,000
Feet

Figure 1-1
Base Location Map
Operable Unit 14 Feasibility Study
Marine Corps Air Station Cherry Point
Cherry Point, North Carolina

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\\aphrodite\Proj\USNavFacEngCom\CherryPoint\Projects\OU14_FS\Figure 1-2 - Base Layout_revised.mxd

Legend

- OU Boundary
- Buildings
- Runway
- Road
- Base Boundary
- Surface Water

N
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0 2,000 4,000
Feet

Figure 1-2
Base Layout
Operable Unit 14 Feasibility Study
MCAS Cherry Point
North Carolina

CH2MHILL

SECTION 2

Site History and Characterization

This section presents information on site history and characteristics, previous investigations, human health and ecological risks, and the nature and extent of contamination at OU14. More-detailed information is presented in the OU14 RI Report (CH2M HILL, 2008).

2.1 MCAS Cherry Point

2.1.1 Facility Description

MCAS Cherry Point is a 13,164-acre military reservation located just north of Havelock in southeastern Craven County, NC (Figure 1-1). The boundaries of MCAS Cherry Point are the Neuse River to the north, Hancock Creek to the east, NC Highway 101 to the south, and an irregular boundary approximately ¾-mile west of Slocum Creek (Figure 1-2).

Commissioned in 1942, MCAS Cherry Point provides support facilities and services for the Second Marine Aircraft Wing, the Fleet Readiness Center—East (FRCE, formerly Naval Aviation Depot [NADEP]), Service Support Detachment 21 of the Second Force Service Support Group, the Naval Air Maintenance Training Group Detachment, and the Defense Reutilization and Marketing Office. MCAS Cherry Point maintains facilities for training and supporting the Atlantic Fleet Marine Force aviation units and is designated as a primary aviation supply point. Hazardous wastes have been generated at the Air Station during historical aircraft assembly and maintenance operations. These wastes include plating wastes, organic solvents, paint removers and cleaners, oils and lubricants, waste petroleum, and polychlorinated biphenyls (PCBs).

MCAS Cherry Point is located in the Tidewater region of the Atlantic Coastal Plain Physiographic Province. The topography of this portion of the Coastal Plain Province is relatively flat, with an average elevation of 20 ft above mean sea level (msl). Coastal areas are of generally low relief and swampy, and characterized by large tidal streams and their tributaries. Drainage across the Air Station is directed to several surface water bodies by a series of storm sewers, drainage ditches, and tributaries to the various creeks. Some tidal influences occur in Slocum Creek and Hancock Creek. Slocum Creek and Hancock Creek (and all surface water bodies at MCAS Cherry Point) are classified as Class C estuarine water by NCDENR. These waters are suitable for fish and wildlife and secondary recreation (i.e., not considered suitable for swimming or potable use).

2.1.2 Facility Environmental History

MCAS Cherry Point has been actively involved with environmental investigations and remediation programs since 1983, beginning with the Navy Assessment and Control of Installation Pollutants (NACIP) Program (modeled after the USEPA Superfund Program). An Initial Assessment Study (IAS) was the first investigation of potentially hazardous sites at MCAS Cherry Point conducted under NACIP in 1983. The purpose of the IAS was to collect and evaluate evidence of pollutants that may have contaminated a site or that posed

an imminent human health hazard. Fourteen sites identified in the IAS were determined to require further investigation (Water & Air Research, 1983).

The Navy's Installation Restoration Program (IRP) was initiated in 1986, following enactment of the SARA legislation, and replaced the NACIP. The IRP has since been renamed the Environmental Restoration Program (ERP) by the Navy. A Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) was conducted at MCAS Cherry Point in 1988. The RFA was the first step under the RCRA corrective action process and consisted of a preliminary review of all available relevant documents, visual site inspections, and sampling when appropriate. The RFA findings led to RCRA Facility Investigations (RFIs) at several sites (A.T. Kearney, 1988). In 1989, the Navy entered into a RCRA Administrative Consent Order with USEPA to perform RFIs at other sites identified in the RFA (USEPA, 1989a).

MCAS Cherry Point was scored and ranked by USEPA for inclusion on the CERCLA (or Superfund) National Priorities List (NPL) in December 1994. Under CERCLA, the Navy acts as the lead agency in partnership with USEPA and NCDENR to manage environmental investigations at the facility through the ERP. Owing to the NPL designation and the RCRA Consent Order, ongoing ERP investigations are conducted to meet the requirements of both RCRA and CERCLA. In May 2005, the Navy, USEPA, and NCDENR (i.e., Partnering Team) executed a Federal Facility Agreement (FFA) for MCAS Cherry Point (NAVFAC, 2005). The FFA effectively terminated the RCRA Consent Order. Under the FFA, all past and future work at ERP sites will be reviewed by the Partnering Team, and a course of action for future work requirements at each site will be developed.

As part of the requirements established under CERCLA, an administrative record file has been established for the ERP at MCAS Cherry Point. The administrative record is a compilation of all documents that the Navy uses to select a remedial action or removal action for a site. The administrative record also serves as the basis for any future legal review of decisions made by the Navy concerning remedial action taken at a site. The MCAS Cherry Point administrative record file is currently available for review online as part of the MCAS Cherry Point public web site at http://public.lantops-ir.org/sites/public/cherrypoint/AdminRecord.aspx.

2.2 Operable Unit 14

2.2.1 Site Description and History

OU14 is located in the west-central portion of the MCAS Cherry Point flight-line complex. Other than some grassy areas adjacent to Runway 14L, the ground surface at OU14 is almost completely covered by pavement, buildings, and aircraft taxiways. The topography at OU14 is relatively flat, averaging approximately 25 ft above msl. The OU14 ground surface slopes gently to the north, with most surface water draining into an unnamed stream paralleling the southern side of Runway 14L. The unnamed stream crosses under Runway 14L and joins Mill Creek to the north (Figure 2-1).

OU14 consists of the area including and surrounding Building 130 (designated as Site 90) and extending approximately 5,000 feet (ft) north-northwest to the unnamed stream adjacent to Runway 14L. Building 130 is a large aircraft hangar containing two large aircraft

bays, storage rooms, and administrative offices. A broad expanse of concrete pavement generally surrounds the building and extends northward and eastward to aircraft taxiways and Runway 14L.

Site Features and Contamination Being Addressed By the ERP

The Site 90 designation originated from the discovery in 2000 of chlorinated solvent contamination in groundwater near Building 130 during the investigation of adjacent Operable Unit 1 (OU1), located a short distance to the southwest (TetraTech NUS [TTNUS], 2002). Because of this discovery, a new IRP site (Site 90, Building 130 VOC-Contaminated Groundwater) was defined and assigned to a new operable unit designation, OU14.

There is no known documentation concerning the use, disposal, spill, or release of chlorinated VOCs (CVOCs) at OU14. As a result, "source areas" of CVOC contamination have largely been inferred by evaluating the distribution of CVOCs in groundwater and by noting the proximity of the areas with the highest CVOC contamination to site features of the types that are typically associated with similar contamination at other military installations. Based on this evaluation, the most likely former CVOC source areas at OU14 include (see Figure 2-1 for locations):

1. Building 130 area (specifically the Building 130 Wash Rack)
2. The C-130 Wash Rack
3. Building 4075 area (which includes a former waste solvent underground storage tank [UST], a hazardous waste aboveground storage tank [AST], and a wash rack)
4. Former refueling station near Building 4495

The Building 130 Wash Rack is constructed of concrete and located adjacent to the southeast side of the building. It has been used to wash aircraft and related equipment since the early 1940s and is currently used to flush aircraft fuel drop tanks with water. Rinse water at the wash rack drains to a diversionary catch basin (located near Sixth Avenue) that is connected to the industrial sewer system (Figure 2-2), which drains to the base Industrial Wastewater Treatment Plant (IWTP). Portions of the industrial sewer system were reportedly constructed of clay pipe, which can crack and break with age. The Air Station has been repairing or upgrading older sections of the industrial sewer system, but it is possible that solvents in rinse water from historical practices at OU14 wash racks could have been released to the subsurface through leaking sewer pipes in the past.

Site Features and Contamination Being Addressed By the UST Program

Petroleum contamination associated with USTs and associated pipelines are not within the jurisdiction of the ERP, and are instead addressed as part of the MCAS Cherry Point UST Program. Site features associated with UST Program investigations are discussed briefly here, because petroleum-related contamination is widespread across OU14 and is commingled with CVOC groundwater contamination in many places.

UST Program investigations in the Building 130 area began after petroleum releases were discovered circa 1994 during Base Realignment and Closure (BRAC) preconstruction sampling efforts. Most of the petroleum-related contamination in the OU14 area is associated with a network of abandoned underground fuel pipelines surrounding Building 130 that consists of several miles of piping connected to Tank Farm A, located

approximately 600 ft northwest of Building 130 (Figure 2-2). This pipeline network was previously used to refuel aircraft at multiple fueling stations on the tarmac surrounding Building 130.

Former petroleum USTs in the OU14 area represent other potential sources of petroleum contamination. An addition to the southwest side of Building 130 was constructed circa the 1950s over a portion of the abandoned fuel pipeline adjacent to Sixth Avenue and over a suspected lubrication oil/waste oil UST of unknown size. No records have been found indicating the UST was removed, and it is assumed to have been abandoned in place. An addition to the northeast side of the building was also apparently constructed at this time over another former UST that is also assumed to have been abandoned in place. A 1944 base construction drawing shows the locations of these USTs (Law Engineering, 1995).

2.2.2 Geology and Hydrogeology

Information about the nature of the subsurface at MCAS Cherry Point as described in this section is based on investigations conducted by the U.S. Geological Survey (USGS), previous ERP studies, and from the OU14 RI site boring logs. More-detailed information is provided in the OU14 RI Report.

The subsurface geology beneath OU14 consists of nine hydrostratigraphic units: five aquifers and four confining units that extend to a depth of approximately 500 ft. From shallowest (youngest) to deepest (oldest), the aquifers with associated confining units include the Surficial, Yorktown, Pungo River, Upper Castle Hayne, and Lower Castle Hayne aquifers. Each aquifer is separated by a confining unit except where these units are absent or discontinuous (USGS, 1996).

Only the Surficial Aquifer and Yorktown confining unit/aquifer were evaluated as part of the OU14 RI. Investigation activities at OU14 only extended to the Yorktown aquifer since groundwater contamination was previously only detected within the uppermost aquifers at MCAS Cherry Point. The OU14 RI confirmed that contaminant concentrations exceed regulatory standards only in the Surficial Aquifer and that groundwater contamination is not likely to migrate to deeper aquifers.

The Surficial Aquifer has been evaluated as two different groundwater zones due to differences in aquifer properties. The *Upper* Surficial Aquifer generally refers to the top half of the Surficial Aquifer, within which the shallowest monitoring wells are installed near the water table with screen intervals between 10 and 25 ft below ground surface (bgs). The *Lower* Surficial Aquifer generally refers to the bottom half of the Surficial Aquifer, within which deeper wells are installed with screen intervals between 25 and 60 ft bgs. The Upper Surficial Aquifer generally contains finer-grained materials relative to the Lower Surficial Aquifer. However, the Upper and Lower Surficial Aquifers are not separated by any confining unit and are in direct hydraulic communication.

Two cross-sections of the hydrostratigraphic units are presented in Figures 2-11 and 2-12 to illustrate the hydrogeologic framework underlying OU14 (see transects on Figures 2-3, 2-4, and 2-8 through 2-10). A brief description for each of the hydrostratigraphic units is presented below. Additional details can be found in the Final OU14 RI Report (CH2M HILL, 2008).

Surficial Aquifer groundwater is not currently used as a potable or nonpotable water supply at MCAS Cherry Point. It is unlikely that it will be used as a future potable water supply under continuing industrial use of MCAS Cherry Point by the Navy.

Surficial Aquifer

Geology. Aside from some relic beach ridges and recent alluvium, USGS identified the Surficial Aquifer materials at MCAS Cherry Point as the Flanner Beach Formation (Murray and Keoughan, 1990). The Surficial Aquifer consists of unconsolidated and interfingering beds of fine sand, silt, clay, shell and peat beds, with scattered coarse-grained sands.

The soil boring activities associated with monitoring well installation during Phase III of the RI allowed a more site-specific examination of the shallow subsurface soils at OU14. The Surficial Aquifer beneath OU14 was found to be typically composed of poorly-graded sands that ranged from fine to medium in grain size, with varying percentages of clays and silts. A coarsening downward trend in grain size was noted within the aquifer. Shell fragments were sometimes observed at the base of the aquifer. The thickness of the aquifer at the Air Station ranges from 31 to 68 ft (Eimer et al., 1994), and the boring logs indicate that the thickness of the aquifer underlying OU14 ranges from 38 to 54 ft.

Hydrogeology. Groundwater potentiometric surface contours generated from monitoring well water-level elevation data collected in April 2005 for the Upper and Lower Surficial Aquifers at OU14 are illustrated in Figures 2-3 and 2-4, respectively.

Groundwater within the Surficial Aquifer at OU14 was generally encountered at a depth of approximately 12 ft bgs. The directions of groundwater flow within the Upper and Lower Surficial Aquifers generally mimic the topography, and flow to the north-northwest and north-northeast towards Mill Creek. However, groundwater flows to the southeast in the Upper Surficial Aquifer in the southern vicinity of Building 130, most likely due to the influence of an operational AS/SVE system. Groundwater mounding observed in this area was also attributed to historical steam line leaks (Law Engineering, 1995). The average horizontal groundwater gradients within the Upper and Lower Surficial Aquifers at OU14 are relatively flat at approximately 0.0014 ft/ft and 0.0020 ft/ft, respectively.

Aquifer hydraulic conductivity ("slug") testing data from the RI were used to calculate the horizontal hydraulic conductivities (K_h) of the Upper and Lower Surficial Aquifers at OU14. The geometric mean K_h of the Upper and Lower Surficial Aquifers were calculated to be approximately 15 and 9 ft/day, respectively. Using an assumed effective porosity of 0.25, the estimated average horizontal groundwater velocities of the Upper and Lower Surficial Aquifers are approximately 31 and 26 ft/yr, respectively.

Vertical gradients calculated from the April 2005 groundwater monitoring well water-level elevation data (see table below) were variable across the site, showing both upward and downward directions. The vertical gradients likely vary seasonally in magnitude and possibly direction, as precipitation and recharge conditions change in the area.

Measured Vertical Hydraulic Gradients Within the Surficial Aquifer – April 2005 data		
Well Pair	Location	Vertical Gradient (ft/ft)
72GW06 / 72GW07	**500 ft northwest of Building 130**	**0.009 upward**
90GW02 / 72GW20	**500 ft north of Building 130**	**0.014 downward**
66GW06 / 66GW46	**Northern part of OU14; 700 ft north of Building 4495 (Former Refueling Station)**	**0.016 downward**
66GW34 / 66GW33	**500 ft north-northwest of the C-130 Wash Rack**	**0.15 upward**

Yorktown Confining Unit

Geology. The Yorktown confining unit underlying the Surficial Aquifer at MCAS Cherry Point consists of clay, sandy clay, and silt, with discontinuous thin beds of fine sand or shells in some areas. Winner and Coble (1996) correlated these soils with the uppermost Yorktown Formation, whereas Murray and Keoughan (1990) identified these soils as the Pleistocene James City Formation. Regardless, the confining unit thickens to the southeast across MCAS Cherry Point, and is thin to absent in the southwest portion of the Air Station (outside of OU14) near Sandy Branch. Based on existing soil boring data, the Yorktown Confining Unit is believed to be continuous beneath OU14.

The Yorktown Confining Unit was encountered during the installation of Yorktown aquifer monitoring wells during the RI at OU14. The confining unit beneath OU14 was found to generally consist of greenish gray silt and clay with some shell fragments. The soils were noted to be soft with low plasticity. The confining unit ranged in thickness from 16 to 20 ft and was generally encountered at 50 ft bgs (26 ft below msl). As noted earlier, the Yorktown Confining Unit appeared to be present at all drilling locations that reached the bottom of the Surficial Aquifer.

Hydrogeology. Due to its fine-grained nature and low permeability, groundwater flow within the Yorktown confining unit is not considered significant. The vertical hydraulic conductivity was estimated by the USGS to be less than 0.05 ft/day (Eimers et al., 1994).

The closest Lower Surficial Aquifer monitoring wells to the two Yorktown Aquifer monitoring wells are 90GW15 and 90GW09. Using water-level elevation data from these wells, vertical gradients across the confining unit can be roughly estimated, and were found to be downward in direction:

Measured Vertical Hydraulic Gradients Between the Surficial and Yorktown Aquifers (Across the Yorktown Confining Unit) – April 2005 data)		
Well Pair	Location	Vertical Gradient (ft/ft)
90GW15 / 90GW17	**Northern part of the study area; North of Building 4495 (Former Refueling Station)**	**0.07 downward**
90GW09 / 90GW18	**Northeast of the C-130 Wash Rack**	**0.09 downward**

Yorktown Aquifer

Geology. USGS identified the Yorktown Aquifer to be part of the Pliocene Yorktown formation. The Yorktown Aquifer consists predominantly of fine sand, silty/clayey sand, and clay, and is characterized by shells and shell beds throughout.

During installation of two Yorktown Aquifer monitoring wells during the RI, it was noted that the Yorktown Aquifer underlying OU14 consisted primarily of fine sand with varying percentages of silt and clay. The aquifer sediments are predominantly greenish gray, dense, and contain shell fragments throughout. The Yorktown Aquifer thickens to the southeast with an average thickness of 35 ft underlying MCAS Cherry Point. Throughout the Air Station, Yorktown Aquifer sediments are estimated to be 70 to 80 percent sand; however, silt and clay content can be variable in the vicinity of MCAS Cherry Point.

Hydrogeology. The hydraulic conductivity of the Yorktown Aquifer averages approximately 15 ft/day (Eimers et al., 1994).

2.2.3 Previous Investigations

No previous investigations or remedial activities specific to OU14 (or Site 90) under CERCLA were conducted prior to the RI; however, several soil and groundwater investigations were performed in support of BRAC construction and the UST Program in and around OU14. In addition, investigations have been conducted at adjacent OU1 in which samples were collected in the vicinity of OU14. Petroleum, oil, and lubricant (POL) contamination suspected to have originated from the abandoned aviation fuel pipeline and USTs at OU14 are managed by and under investigation by the UST Program.

Previous ancillary investigations at OU14 included the BRAC preconstruction sampling effort in 1994 and the Aviation Fuel Line assessments and corrective action in 1995-1997. The BRAC effort revealed POL contamination in soil and groundwater in the vicinity of Building 130 (HNUS, 1994). No CVOCs were detected. The soil and groundwater data were used for a quantitative HHRA for long-term employee occupants and construction workers. No unacceptable risks for these scenarios were identified. The Aviation Fuel Line assessments (Law Engineering, 1995 and 1996) indicated the presence of POL contamination in soil and groundwater, as well as free-phase POL (i.e., free product [FP]). CVOCs were detected in groundwater in the vicinity of the Building 130 Wash Rack and adjacent Building 3745.

A Corrective Action Plan (CAP) was developed for the POL-related groundwater contamination and FP near Building 130 (Law Engineering, 1997). The proposed actions included automated FP recovery, as well as remediation of POL-contaminated groundwater and soil using an air sparge (AS) and soil vapor extraction (SVE) system (Law Engineering, 1997). In addition, the CAP included monitored natural attenuation (MNA) of POL contaminants beyond the treatment area. These systems were installed in 2001, and the corrective action efforts, including periodic sampling, are ongoing (J.A. Jones Environmental Services Company, 2000) under the UST Program.

OU1 Remedial Investigation — 2000

In 2000, TTNUS collected groundwater samples as part of the OU1 RI. OU1 is separated hydraulically from OU14 by a groundwater flow divide located within OU1, and includes

the FRCE and the industrial areas of the Air Station near the FRCE. The flow divide does not allow groundwater contamination from OU1 to reach OU14. During the OU1 RI, POL-related compounds and CVOCs were detected in groundwater in the southern vicinity of Building 130. The building and immediately surrounding area was designated Site 90 and an RI was initiated in 2001. OU1 RI/FS efforts are ongoing.

OU14 Remedial Investigation — 2002-2006

The OU14 RI field activities were completed in three phases from 2002 through 2006 (CH2M HILL, 2008). All analytical data (soil, sediment, surface water, and groundwater) and field-measured water quality data are provided in Appendix A. Appendix A also includes applicable RI figures and drawings of the current UST Program remediation systems at OU14. Sections 2.2.4 through 2.2.7 provide a discussion of the nature and extent of contamination at OU14, the CSM, a summary of the risk assessments, and the recommendations of the RI.

The objective of Phase I of the OU14 RI was to determine the preliminary extent of CVOC contamination in Surficial Aquifer groundwater and soil via direct push technology (DPT) sampling. Phase II was performed to close identified Phase I data gaps and to include a more comprehensive suite of chemical analyses. During Phase I, DPT groundwater samples were analyzed for VOCs. Unsaturated soil core samples were field-screened for volatiles, inspected visually for any indications of contamination such as staining, and logged for lithology. Elevated field readings and/or visual inspection indicated possible soil contamination at several locations. As a result, soil samples were collected from these locations and analyzed for VOCs.

Combined with UST Program groundwater data, the Phase I data indicated that CVOC contamination in the unconfined Surficial Aquifer extended farther downgradient (northwest) from Building 130 than anticipated. CVOCs detected in excess of maximum contaminant levels (MCLs), NC2Ls, and/or USEPA Region 9 “Tap Water PRGs” included dichloroethanes (DCAs), dichlorethenes (DCEs), trichloroethene (TCE), and vinyl chloride (VC). Non-CVOC contaminants detected in excess of the criteria included POL compounds (e.g., benzene). The compounds detected in the soil in the vicinity of Building 130 did not appear to be related to the CVOC contamination found in the underlying groundwater near Building 130.

During Phase II, 55 monitoring wells were sampled and analyzed for VOCs. The Phase II data (and Phase I and UST Program data) indicated CVOC contamination in the Upper Surficial Aquifer, mostly adjacent to Building 130 but also in the vicinity of the former waste solvent UST near Building 4075. The CVOCs in the Lower Surficial Aquifer were primarily found at three different locations: (1) C-130 Wash Rack; (2) Building 130 Wash Rack; and (3) Building 4075.

Based on the results of the Phase II investigation, a third investigation phase was performed to install new monitoring wells (including two Yorktown Aquifer monitoring wells), review potential preferential pathways for contaminant migration via utilities and utility bedding material, collect hydraulic conductivity data, perform a wide-area groundwater elevation survey, perform a baseline HHRA and a screening ERA, collect sediment and surface water

samples from the downgradient unnamed stream to support the HHRA and ERA, and perform a vapor intrusion screening evaluation (part of the HHRA).

The Phase III data, combined with Phase I and II and other historical data, showed no indication of the presence of continuing CVOC sources. However, continuing sources of benzene and other POL compounds were evidenced by correlating POL soil and groundwater data and the reported presence of FP over large areas of the site by the UST Program. The continuing presence of POL FP allows the long-term dissolution of POL compounds into the Surficial Aquifer groundwater. Dissolved-phase POL contamination has spread to the point where it is also present at most locations where CVOC contamination has been detected. The commingled POL compounds likely serve as a carbon/energy source for naturally-occurring anaerobic dechlorinating bacteria in the aquifer, facilitating reduction in CVOC concentrations.

No ecological risks were determined from the ERA (see Section 2.2.6). No unacceptable human health risks were determined from the HHRA for Yorktown Aquifer groundwater, surface water, or sediment; however, potential unacceptable human health risks were determined for exposure to Surficial Aquifer groundwater and indoor air vapor (see Section 2.2.6).

Relative to POL compounds, few CVOCs were detected in soil at OU14. During RI sampling activities, CVOCs were found at concentrations exceeding one or more screening criteria in only one sample collected in 2002. An additional sample was collected at this same location and depth in 2008, and no CVOCs were detected above screening criteria. An SVE well was subsequently installed by the UST Program at this location to remediate POL contamination; any residual CVOC contamination at this location would also be remediated by this SVE well. Due to the lack of significant soil CVOC contamination, and due to the lack of exposure pathways to soil at OU14 (historical source areas are covered by buildings and concrete), soil was not evaluated in the quantitative risk assessments. Screening for potential soil risk was conservatively performed by identifying exceedances of NC Soil Screening Levels (SSLs). No CVOCs exceeded SSLs in the most recent sampling event. Therefore, no soil contaminants were identified as CERCLA COCs.

An FS (described herein) was recommended to evaluate alternatives to mitigate the potential human health risk associated with Surficial Aquifer groundwater (including potential vapor that could emanate from CVOCs in the groundwater). The following sections provide further details on the RI findings and conclusions.

2.2.4 Nature & Extent of Contamination

The sampling activities conducted during the three-phase RI for OU14 consisted of subsurface soil, groundwater, sediment, and surface water sampling. Phases I and II field investigation activities were conducted in October 2002 and October 2003, respectively. Phase III soil and groundwater sampling was conducted in March through April of 2005. Phase III sediment and surface water sampling was conducted in April 2006.

An additional groundwater sample was collected in August 2007 to confirm the April 2005 groundwater data in well 90GW17. An additional subsurface soil sample was collected in September 2008 to confirm the October 2002 soil data at location 9009SB. Appendix A

presents all analytical data, field-measured water quality data, and reference figures from the RI.

Subsurface Soil

No surface soil samples were collected at OU14 during RI activities because virtually all of OU14 is covered by pavement, buildings, and aircraft taxiways. The only grassy areas within OU14 are near Runway 14L, far from any suspected or inferred contaminant source areas.

Subsurface soil samples were collected during the RI at boring/well installation locations where PID readings were elevated during soil headspace screening (Figure 2-5 and *OU14 RI Table 5-3* provided in Appendix A). The subsurface soil samples were analyzed for VOCs (POL VOCs and CVOCs were the contaminants under investigation).

Multiple non-CVOCs were detected in subsurface soil. Of these, POL compounds were the most prevalent, and exceeded screening values (e.g., NC SSLs) in and around Tank Farm A (Figure 2-5). The POL contamination resulted from historical releases from leaky fuel pipelines and USTs used historically in the study area. Free-phase petroleum product is present as a floating layer above the water table (Figure 2-9) and as residuum in soil across extensive areas of the site. Collocated groundwater samples at locations with significant soil contamination contained benzene and other POL compounds, suggesting that site soil may contribute to POL contamination in groundwater; however, this would likely be due to a fluctuating groundwater table contacting POL residuum in soil or from the presence of floating FP rather than the result of precipitation infiltrating and leaching contamination from above (because the site is covered by concrete and buildings).

Minimal CVOC contamination was found in soil across OU14. Some of the CVOCs found widely in groundwater were detected at minimal concentrations in soil samples; however, no evidence has been discovered to date indicating the existence of significant pockets of CVOC soil contamination in the subsurface acting as ongoing sources for groundwater contamination. The presence of buildings and concrete covering virtually the entire site restricts the ability of precipitation to infiltrate subsurface soils and leach contamination from soil into the groundwater at OU14.

At the one sample location (9009SB) where CVOCs exceeded NC SSLs in soil in a 2002 sample, the same CVOCs were not detected at that location in the underlying groundwater. Another soil sample was collected from this same location and depth in September 2008 to determine if existing UST Program remediation system(s) had affected the VOC concentrations since the time of the earlier sample. No CVOCs were detected in the September 2008 sample (Figure 2-5 and *RI Table 5-3*). POL concentrations also decreased since the 2002 soil sample at this location. This is likely due to vicinity UST Program SVE remedial systems, natural degradation, desorption, and volatilization mechanisms over the 6 years since the previous sample was collected in 2002. The UST Program installed a new SVE well at this location following the collection of the September 2008 sample to continue to treat the POL contamination in soil in this vicinity. The SVE well at this location (and vicinity systems) will continue to remove volatiles from soil above the water table.

Because no major CVOC-contaminated soil source areas were evident and since virtually all site soil is covered by pavement and buildings, CVOCs in soil are not (or are no longer) contributing significantly to groundwater CVOC contamination.

Groundwater

Groundwater samples were collected from the upper and lower portions of the Surficial Aquifer as well as the Yorktown Aquifer (which is separated from the Surficial Aquifer by the Yorktown Confining Unit). A summary of the analytical and field-measured data from the RI is provided below (Figures 2-6 through 2-12; *RI Tables 3-4, 3-5, and 5-4 through 5-9*). All groundwater samples were analyzed for VOCs. A subset of the samples were also analyzed for inorganic constituents (e.g., arsenic, iron, and manganese) and various geochemical parameters used to evaluate the potential for natural biodegradation of VOCs (e.g., nitrate, sulfate, and total organic carbon [TOC]).

Upper Surficial Aquifer. CVOC plumes in the Upper Surficial Aquifer appear to have originated from the following former source areas (Figures 2-6, 2-8, 2-11, and 2-12): Building 130 area (TCE); Building 130 Wash Rack (VC); C-130 Wash Rack (TCE and VC); Building 4075 area (TCE); and the Former Refueling Station near Building 4495 (TCE). Based on both Upper and Lower Surficial Aquifer data, the plume(s) can be characterized as TCE plumes that have undergone significant biodegradation for many years. Benzene, as well as the other POL compounds, were also identified in the Upper Surficial Aquifer (Figure 2-9) and are likely attributable to POL releases from Tank Farm A, leaking underground fuel lines and USTs, the Former Refueling Station near Building 4495, and the heavy fuel pits. The presence of the POL compounds commingled with the CVOCs in widespread areas of the Upper Surficial Aquifer groundwater has likely facilitated the significant biodegradation of the CVOCs.

CVOCs. In 2005, TCE was detected in exceedance of the NC2L (2.8 µg/L) at six monitoring well locations (13GW12, 56GW02, 66GW35, 66GW47, 90GW04, and 90GW06), with a maximum concentration of 180 mg/L in monitoring well 56GW02, located immediately downgradient of Building 4075. Detected VC concentrations exceeded the NC2L (0.015 µg/L) at five monitoring well locations (13GW12, 66GW34, 72GW04, 72GW21, and OU1-MW61), with a 2005 maximum concentration of 12 µg/L in monitoring well OU1-MW61, located at the Building 130 Wash Rack (down from 110 µg/L in a 2003 sample). VC was detected at 28 µg/L at well 72GW04 in 2003, but this well was not sampled again in 2005. Cis-1,2-DCE was detected in 16 monitoring wells but did not exceed the NC2L (70 µg/L). The maximum 2005 cis-1,2-DCE concentration was 30 µg/L at well 56GW02.

Non-Chlorinated VOCs. POL and other non-CVOCs were detected in the Upper Surficial Aquifer monitoring wells in exceedance of NC2Ls. The highest concentrations of POL compounds were detected downgradient of Tank Farm A, C-130 Wash Rack, Building 4075, and the area of the Former Refueling Station and heavy fuel pits (Figure 2-9). These are likely locations of POL releases (free product [FP] is currently present throughout these areas) resulting from leaks in the fuel pipelines and/or USTs. Benzene, toluene, ethylbenzene, and xylene (BTEX) compounds were also detected southeast of Building 130 in the vicinity of abandoned fuel pipelines and the Building 130 Wash Rack. In addition to other attenuation mechanisms, the presence of commingled dissolved-phase POL compounds in the CVOC plumes has likely facilitated microbially–mediated biodegradation

of the CVOCs to their present extent, because the POL compounds are available as carbon and/or energy sources by indigenous dechlorinating bacteria.

Benzene concentrations in the Upper Surficial Aquifer ranged from non-detect to 470 µg/L (maximum concentration at well OU14-66GW28 located between the C-130 Wash Rack and Building 4075). Specific hot spots of benzene coincide with the areas described above. Multiple UST Program remedial systems are currently operating at OU14 (UST remedial system diagrams provided in Appendix A). An intricate FP recovery and SVE system is active throughout OU14, focusing on POL contamination in soil and groundwater associated with underground fuel lines and Tank Farm A. An AS/SVE and FP recovery system at Building 130 currently treats dissolved-phase POL, removes FP, and treats soil contamination in the vicinity of the building. These treatment systems continually reduce POL concentrations in at least the upper portion of the Surficial Aquifer. AS and SVE systems treat all VOCs, including chlorinated solvents, in addition to volatile POL contaminants.

Metals. Arsenic was detected in 16 out of 32 sampled Upper Surficial Aquifer monitoring wells. Of the 32 sampled monitoring wells, 4 contained concentrations (39.3 to 69.9 µg/L) that exceeded the range of natural arsenic background concentrations for MCAS Cherry Point. The spatial distribution of these several arsenic detections above background concentrations is sporadic, and does not suggest a CERCLA release that is related to historical or present site operations.

Iron and manganese were detected in exceedance of the NC2Ls in several monitoring wells, with maximum concentrations of 58,300 µg/L and 4,050 µg/L, respectively, both found in the sample collected from well 90GW01 at Building 130. However, out of 32 sampled Upper Surficial Aquifer monitoring wells, only 5 iron and 2 manganese detections exceeded the range of natural background concentrations for MCAS Cherry Point. The spatial distribution of these several detections above background concentrations is sporadic, and does not suggest a CERCLA release that is related to historical or present site operations.

Lower Surficial Aquifer. CVOC plumes in the Lower Surficial Aquifer appear to have originated from the Former Refueling Station and the Building 130 area (and/or fuel lines downgradient of Building 130) (Figures 2-7, 2-8, 2-11, and 2-12). Based on both Upper and Lower Surficial Aquifer data, the plume(s) can be characterized as TCE plumes that have undergone significant biodegradation for many years. POL compounds were also identified in the Lower Surficial Aquifer (Figure 2-10) and are likely attributable to POL releases from Tank Farm A, leaking underground fuel lines and USTs, the Former Refueling Station near Building 4495, and the heavy fuel pits. The presence of the POL compounds commingled with the CVOCs in widespread areas of the Lower Surficial Aquifer groundwater has likely facilitated the significant biodegradation of the CVOCs.

CVOCs. All of the CVOCs detected in the Upper Surficial Aquifer were also detected in the Lower Surficial Aquifer. TCE and cis-1,2-DCE (biodegradation breakdown product of TCE) were the most frequently detected CVOCs in both portions of the Surficial Aquifer. The highest 2005 concentrations of TCE in the Lower Surficial Aquifer occurred at monitoring well 72GW19 (19 µg/L) located downgradient of Building 130, and 56GW09 (15 µg/L) located between the Former Fueling Station and the heavy fuel pits. TCE concentrations were also the highest in these wells in 2003 samples, at 22 µg/L (72GW19) and 98 µg/L

(56GW09) (concentrations decreased from 2003 to 2005). Cis-1,2-DCE detections were highest in the samples from 13GW11 (180 µg/L), 13GW29 (98 µg/L), and 72GW19 (92 µg/L), all located downgradient of Building 130 and in the vicinity of the C-130 Wash Rack. Most TCE and DCE exceedances in the Lower Surficial Aquifer were located in this area. VC was detected in 2005 at 2.3 µg/L in well 13GW29, located directly downgradient of the C-130 Wash Rack (Figure 2-7).

Non-Chlorinated VOCs. POL compounds and other non-CVOCs were detected at concentrations exceeding NC2Ls, including benzene, xylenes, and methyl-tert-butyl ether (MTBE). Benzene was detected above screening values most frequently, with the highest concentration of 2,000 µg/L in well 13GW29, located directly downgradient of the C-130 Wash Rack and Tank Farm A (Figure 2-10). MTBE and xylenes concentrations were also highest in well 13GW29. Benzene is prevalent throughout OU14, with many plumes originating from the aforementioned sources commingling into one large plume. The presence of benzene and other commingled dissolved-phase POL compounds over large portions of the CVOC plumes has likely facilitated the microbially–mediated biodegradation of the CVOCs to their present extent, as the POL compounds are available to serve as carbon and/or energy sources in the reductive dechlorination process.

Metals. There were no detected concentrations of arsenic out of 23 sampled Lower Surficial Aquifer monitoring wells that exceeded natural arsenic background concentrations for MCAS Cherry Point. Iron and manganese were detected in exceedance of the NC2Ls in several monitoring wells, with maximum concentrations of 10,300 µg/L (56GW09 near the heavy fuel pits) and 513 µg/L (90GW12 located 1,000 ft cross-gradient to the north of Building 130). However, out of 23 sampled Lower Surficial Aquifer monitoring wells, only 1 iron and 4 manganese detections exceeded the range of natural background concentrations for MCAS Cherry Point. The spatial distribution of these several detections above background concentrations is sporadic, and does not suggest a CERCLA release that is related to historical or present site operations.

Yorktown Aquifer The most recent groundwater data from the two Yorktown Aquifer wells (well 90GW17 data from 2007; 90GW18 data from 2005) show no detections of CVOCs, indicating that there has been no significant migration of CVOCs from the Surficial to the Yorktown Aquifer. POL compounds were detected at *de minimis* concentrations in well 90GW18 (below the NC2L). There were no exceedances of NC2Ls in the Yorktown Aquifer wells for any detected constituent.

Natural Attenuation Indicator and Other Wet Chemistry Parameters in Groundwater

As stated earlier, the groundwater data for OU14 indicate that the CVOC plumes in the Upper and Lower Surficial Aquifers can be characterized as TCE plumes that have undergone significant biodegradation for many years. The primary evidence for this conclusion is the relatively low concentrations of TCE remaining in OU14 groundwater and the widespread presence of "daughter products" (i.e., less-chlorinated CVOCs resulting from the biodegradation of TCE via reductive dechlorination, such as cis-1,2-DCE and VC). Based on the data collected to date, the OU14 RI report concluded that there are no known continuing sources of CVOCs and that the CVOC plumes have stabilized.

Further evidence of natural biodegradation of CVOCs at OU14 was obtained during the RI through the analyses of selected groundwater samples for several natural attenuation evaluation parameters, including pH, oxidation-reduction potential (ORP), and total organic carbon (TOC), as well as analytes indicative of several terminal electron-accepting processes (TEAPs) (e.g., DO, nitrate/nitrite, iron II/III, and sulfate/sulfide). These data can be used to further evaluate whether biodegradation of the CVOCs in groundwater is occurring naturally under anaerobic conditions at OU14. Analytical and field-measured data from the RI are provided in *RI Tables 3-4 and 3-5* (Appendix A).

Changing electron acceptors, pH, and electron donors can define the reductive dechlorination bacterial community (Suthersan and Payne, 2005). Within the chemically and microbially complex aquifer, there is no one biochemical mechanism or any one single bacterium that is completely responsible for the entire transformation and degradation process. Instead, it is a consortium of microorganisms and a variety of mechanisms that bring about the desired transformation pathways of the target contaminants. The microbial community is considered to function as a super-organism—metabolizes collectively, shares biodegradative genes, and evolves collectively to biodegrade new compounds that enter the environmental niche (Suthersan; Wackett and Hershberger, 2001).

A variety of metabolic process have been identified in anaerobic dechlorinating bacteria. Chlorinated compounds can serve three different metabolic functions in anaerobic bacteria (Suthersan): (1) as carbon and/or energy sources; (2) as substrates of cometabolic activity; and (3) as terminal electron acceptors in an anaerobic process (e.g., dehalorespiration). The main reductive dechlorination processes are cometabolism and dehalorespiration. The sequence of TEAPs in the metabolic pathway, ranked in approximate order of decreasing energy yield per reaction, is oxygen (aerobic respiration), nitrate (denitrification), iron III (iron III reduction), sulfate (sulfate reduction or sulfanogenesis), and carbon dioxide (CO_2) or carbonate (methanogenesis) (Suthersan). Manganese IV (manganese IV reduction) can also be an electron acceptor between ferric iron and sulfate. CVOCs can be used as electron acceptors generally after nitrate and ferric iron are exhausted. An evaluation of concentrations of these terminal electron acceptors (presence or lack thereof) and other data can help determine the prevalent TEAPs throughout the aquifer microbial continuum—a succession of microbial community structures and changing oxidation-reduction conditions, aligned along the flow path of the plume—which provide another line of evidence of natural attenuation.

pH and Carbon Source. The pH of ground water has an effect on the presence and activity of microbial populations in ground water. The optimal pH range for reductive dechlorination is 5 to 8 standard units (USEPA, 1998). Values of pH throughout the Surficial Aquifer during the OU14 RI ranged from 4.3 to 9.5 (average was 6; half the values were above 6 [median = 6]). These pH values in the Surficial Aquifer suggest sufficient to ideal conditions for reductive dechlorination.

USEPA (1998) reports that TOC values greater than 20 mg/L are optimal to drive dechlorination. TOC values in the Surficial Aquifer ranged from 5 to 43 mg/L (average was 12.4 mg/L; median was 9 mg/L), representing both natural particulate and dissolved organic carbon in the aquifer, as well as anthropogenic carbon from dissolved-phase POL compounds. The data show that half of the TOC values were below 9 mg/L; however, only 19 of the 79 monitoring wells were sampled and analyzed for TOC.

All of the monitoring wells sampled during the RI were analyzed for BTEX compounds. BTEX at concentrations greater than 100 µg/L can also provide carbon and energy to drive reductive dechlorination (USEPA, 1998; Nyer). Total BTEX concentrations in the Surficial Aquifer ranged from less than 1 to 3,300 µg/L (average was 121 µg/L; median was 30 µg/L). These BTEX compound concentrations suggest ample carbon and energy availability for biodegradation of CVOCs in the Surficial Aquifer at OU14.

Dissolved Oxygen (DO). DO concentrations were measured in each of the monitoring wells at OU14 to determine if aerobic or anaerobic conditions are present in the aquifer. DO concentrations below 0.5 to 1 mg/L are indicative of anaerobic conditions (USEPA, 1998). CVOCs can be readily degraded by indigenous microbes via the reductive dechlorination pathway under anaerobic conditions. After depletion of DO by aerobic microbes using natural or anthropogenic (e.g., POL compounds) organic matter in the aquifer, anaerobic microbes will use nitrate as an electron acceptor (followed by iron III, sulfate, and finally CO_2). Each sequential reaction drives the ORP of the groundwater downward into the range within which reductive dechlorination can occur (USEPA, 1998).

The DO concentrations recorded during groundwater sampling indicate that both aerobic and anaerobic conditions exist in the upper and lower portions of the Surficial Aquifer depending on location. Within the Upper Surficial Aquifer, DO concentrations ranged from 0 (at multiple well locations) to 9.66 mg/L (at well 72GW28). Within the Lower Surficial Aquifer, all DO concentrations were below 1 mg/L, except at wells 13GW29 (1.6 mg/L) and 66GW46 (2 mg/L). Anaerobic conditions were present in the areas of greatest TCE and other CVOC concentrations (Figure 2-8 and *RI Tables 3-4 and 3-5*). No DO was detected within the most-concentrated CVOC areas, represented by conditions in (1) well 56GW02, located north of Building 4075; (2) well 56GW09, located at the Former Refueling Station; (3) wells 13GW11 and 90GW09, located north of the C-130 Wash Rack and southeast of Building 250; and (4) well OU1-MW61 at the Building 130 Wash Rack.

The DO results for OU14 groundwater were generally favorable with respect to natural anaerobic biodegradation of CVOCs. Anaerobic conditions were present in the areas of highest TCE and other CVOC concentrations in the Upper and Lower Surficial Aquifers.

Some CVOCs can biodegrade under aerobic aquifer conditions via direct oxidation and/or cometabolic processes by aerobic bacteria (USEPA, 1998; Suthersan). Aerobic conditions typically occur downgradient from anaerobic zones where electron donors are being utilized by reductive dechlorination processes. Biodegradation of less-chlorinated daughter products (e.g., DCE and VC) can occur readily under these aerobic conditions. Aerobic biodegradation of CVOCs at OU14 is also likely in aerobic zones in the aquifer created by UST Program AS systems; however, aerobic biodegradation in these areas would not be termed 'natural,' but rather 'enhanced' aerobic biodegradation because it is a result of the injection of air into the aquifer.

Oxidation-Reduction Potential (ORP). The ORP of groundwater is a measure of electron activity and is an indicator of the relative tendency of a solution to accept or transfer electrons (USEPA, 1998). Biological processes generally occur within a prescribed ORP range. Reductive dechlorination is most effective in the ORP range corresponding to sulfate reduction and methanogenesis, but dechlorination of PCE and TCE also may occur in the

ORP range associated with denitrification or iron III reduction. Dehalogenation of DCE and VC generally are restricted to sulfate-reducing and methanogenic conditions.

As microbial activity depletes available electron acceptors, ORP decreases. ORP less than +50 millivolts (mV) is one indicator of conditions favorable to reductive dechlorination; however, ORP less than -100 mV is considered most ideal (USEPA, 1998). Negative ORP generally indicates reducing conditions; however, the groundwater pH and the specific available electron acceptors are also factors that determine the magnitude of reducing conditions. Oxygen introduced to the aquifer via airflow injected by the UST Program AS systems increase the ORP (more positive value) in the vicinity and downgradient of the systems.

Within the Upper Surficial Aquifer, ORP ranged from -320 mV (90GW03) to +495 mV (66GW28). The ORP measurements within the Lower Surficial Aquifer ranged from -326 mV (90GW18) to +551 mV (90GW11). ORP values suggesting reducing conditions were measured in the areas of greatest TCE and other CVOC concentrations (Figure 2-8 and *RI Tables 3-4 and 3-5*): ORP was negative within the most concentrated CVOC areas, represented by conditions in: (1) well 56GW02 (-119 mV), located north of Building 4075; (2) well 56GW09 (-50 mV), located at the Former Refueling Station; (3) well 90GW09 (-84 mV), located north of the C-130 Wash Rack and southeast of Building 250 (although well 13GW11 measured +144 mV); and (4) well OU1-MW61 (-128 mV) at the Building 130 Wash Rack.

The ORP results for OU14 groundwater were generally favorable with respect to the potential for natural anaerobic biodegradation of CVOCs. In the areas of highest TCE and CVOC concentrations in the Upper and Lower Surficial Aquifers, ORP measurements were generally negative values, suggesting the presence of reducing conditions that are favorable to the reductive dechlorination of CVOCs.

Nitrate/Nitrite. After dissolved oxygen has been depleted, nitrate may be used as an electron acceptor for anaerobic biodegradation of organic carbon via denitrification. In order for reductive dechlorination to occur most effectively (i.e., in order for CVOCs to be used as electron acceptors with little competition from nitrate), nitrate concentrations in the contaminated portion of the aquifer should be less than 1.0 mg/L (USEPA, 1998). Nitrite concentrations would be expected to increase in areas where denitrification is occurring.

Within the Upper Surficial Aquifer, nitrate was measured at concentrations ranging from nondetect (less than 0.5 mg/L) to 3.3 mg/L. Nitrate concentrations were less in the Lower Surficial Aquifer, ranging from nondetect (less than 0.5 mg/L) to 0.6 mg/L. Nitrate was detected at 0.4 mg/L and nitrite was not detected in well 56GW02, north of Building 4075, where the TCE concentration (180 µg/L) was greatest at OU14. The absence of nitrate-nitrite throughout OU14 near the suspected former source areas, as well as downgradient of these areas, suggest no significant denitrification in the Surficial Aquifer. DO, nitrate, and nitrite levels were low to non-detect in the Surficial Aquifer. The absence or minimal presence of these higher energy electron acceptors (DO and nitrate) suggests favorable conditions for natural anaerobic biodegradation of CVOCs (i.e., CVOCs can more readily be used as electron acceptors by dechlorinating bacteria).

Iron II/III. In some cases, iron III is used as an electron acceptor during anaerobic biodegradation of organic carbon. During this process, iron III is reduced to iron II. Subsequently, iron II concentrations can be used as an indicator of anaerobic degradation of less-chlorinated CVOCs such as VC (USEPA, 1998). USEPA (1998) suggests using caution when interpreting iron II concentrations because they may be biased low by re-precipitation as sulfides (see below) or carbonates. Only total iron was analyzed during the RI. Iron II will be measured using field test kits during future sampling events.

Sulfate/Sulfide. After DO and nitrate have been depleted and reduction of iron III has been initiated, sulfate may be used as an electron acceptor for anaerobic biodegradation. Reductive dechlorination is generally most effective in the ORP range corresponding to sulfanogenesis and methanogenesis, but dechlorination of PCE and TCE also may occur in the ORP range associated with denitrification or iron III reduction (USEPA, 1998). Dechlorination of DCE and VC generally occurs under sulfate-reducing and methanogenic conditions. Dechlorinating bacteria such as *Dehalococcoides ethonogenes* are flanked by iron- and sulfate-reducing bacteria at the positive and negative ends of their ORP range, respectively (Suthersan; Nyer et al., 2001). That is, CVOCs can be used as terminal electron acceptors at the same time and after iron III, and before and at the same time as sulfate.

Sulfate reduction produces sulfide (sulfide concentrations greater than 1 mg/L suggests sulfate-reducing conditions [sulfanogenesis]). Concentrations of sulfate greater than 20 mg/L can potentially cause competitive electron acceptor exclusion of CVOCs (USEPA, 1998). However, AFCEE (2004) reports that there is ample evidence of dechlorination at sites containing elevated sulfate levels (ITRC, 1998; Devlin and Muller, 1999). Sulfide concentrations greater than 1 mg/L indicate potential reductive dechlorination (USEPA, 1998).

Sulfate concentrations in the Surficial Aquifer ranged from 1 to 1,630 mg/L (average was 66 mg/L; median was 87 mg/L). Sulfide concentrations ranged from 1 to 17 mg/L (average was 2.4 mg/L; median was 1 mg/L), with no detections in the Lower Surficial Aquifer. In aquifers with sulfate greater than 100 to 200 mg/L and ferrous iron greater than 20 mg/L, the hydrogen sulfide produced during sulfanogenesis can react with iron to form iron monosulfide precipitates. These iron-sulfide precipitates can degrade CVOCs abiotically to innocuous products without the production of daughter products (e.g., TCE is chemically reduced directly to innocuous CO_2 and water without the production of cis-1,2-DCE and VC) (AFCEE, 2003, 2004, and 2007; Butler and Hayes, 1999; Lee and Batchelor, 2003).

Sulfanogenesis was most evident in Upper Surficial Aquifer wells 66GW02 (sulfate at 15 mg/L and sulfide at 17 mg/L) and 66GW36 (sulfate at 28 mg/L and sulfide at 11 mg/L), both bordering the east side of the CVOC plume originating from the Building 4075 area (area with the highest TCE concentration of 180 µg/L). Considering the sequence that electron acceptors are used by bacteria (i.e., sequential TEAPs), CVOCs may provide more energy as electron acceptors via dehalorespiration than sulfate via sulfanogenesis in the Surficial Aquifer at OU14. Based on the sulfate and sulfide concentrations in the Surficial Aquifer, the sequential TEAPs, and the potential for iron-sulfide precipitates, CVOC degradation may be occurring both biotically (dehalorespiration) and abiotically (chemical reduction) throughout the Surficial Aquifer.

Conclusion. Groundwater data collected during the RI generally show sufficient to ideal conditions for anaerobic reductive dechlorination in the Surficial Aquifer. In addition, abiotic reduction of CVOCs in the Surficial Aquifer is also likely. Further evaluation of temporal concentrations of COCs, electron acceptors, and other geochemical and natural attenuation evaluation parameters based on data from future sampling events will provide additional evidence of the efficacy of natural attenuation and will allow for refined biodegradation rate estimates.

Surface Water and Sediment

Collocated surface water and sediment samples were collected in April 2006 from the unnamed stream located just south of Runway 14L (Figure 2-13). Surface water and sediment samples were analyzed for VOCs, metals, and wet chemistry and geotechnical analyses. There were no NC2B[5] exceedances in surface water (Figure 2-13 and *RI Table 5-8*). Three CVOCs (TCE; 1,1-DCE; and cis-1,2-DCE) and three non-CVOCs (benzene, cyclohexane, and bromoform) were detected at trace concentrations in surface water in the unnamed stream downgradient of OU14. Arsenic, barium, lead, and selenium were detected in one or more samples. Surface water hardness ranged from 93 to 131 mg/L.

No VOCs were detected in sediment (Figure 2-13 and *OU14 RI Table 5-9*). Six metals (arsenic, barium, cadmium, chromium, lead, and selenium) were detected, but only arsenic and chromium concentrations exceeded any screening values. All concentrations of arsenic and chromium in sediment were below established background soil concentrations for MCAS Cherry Point (TTNUS, 1999). The pH of the sediment was generally neutral, ranging from 6.4 to 8. TOC concentrations ranged from 1,680 to 11,200 mg/kg.

The presence of trace TCE and cis-1,2-DCE in surface water samples from the unnamed stream indicates that groundwater discharge to surface water is a likely contaminant migration pathway. However, all VOC concentrations were below applicable criteria and screening values, no VOCs were detected in sediment, and the nearby CVOC plume(s) are considered to have stabilized.

2.2.5 Conceptual Site Model and Contaminant Fate & Transport

A CSM conveys what is known or suspected about contamination sources, release mechanisms, and the transport and fate of those contaminants. It provides the basis for understanding contaminant fate and transport issues and assessing potential remedial technologies at the site. The CSM for OU14 is derived from available data and accepted principles of groundwater flow and contaminant transport. A complete discussion of the CSM can be found in the OU14 RI Report (CH2M HILL, 2008). Figures 2-11 and 2-12 present interpretive cross-sections of the Surficial Aquifer across the site showing the distribution of TCE, VC, and total CVOCs (greater than 200 µg/L), potential contaminant source areas, UST remediation systems currently operating, buildings, and other features.

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[5] NC2B refers surface water and wetland standards as defined in the NC Administrative Code, Title 15A, Chapter 2, Subchapter 2B. Further, for OU14, the NC2B refers to the Class C surface water standards (more stringent of Freshwater Aquatic Life and Human Health values) for human health comparison and the more stringent of Freshwater Aquatic Life and Trout Waters values for ecological comparison.

Based on the results of previous investigations and the accumulated chemical and physical data, the following potential former CVOC-source areas and/or potential former [or current] POL-contaminant source areas have been identified at OU14 (refer to Figures 2-1 and 2-2 for locations):

- Building 130 area (Building 130, Vicinity Abandoned and/or Leaky Fuel Lines, and Building 130 Wash Rack)
- Building 4075 area (former waste solvent UST, hazardous waste storage, and wash rack)
- Former Refueling Station near Building 4495 and the Heavy Fuel Pits
- C-130 Wash Rack
- Tank Farm A
- Stormwater drainage lines, sanitary sewer lines, industrial wastewater lines, jet fuel distribution system, USTs.

CVOC spills are a potential historical source; however, there are no documented solvent releases at OU14. The primary mechanisms for contaminant transport from the potential source areas at the site are believed to be as follows:

- Infiltration of CVOC and POL contaminants into the subsurface from leaky stormwater or industrial sewer pipes, leaky drains or pipes associated with aircraft wash racks or other structures, or through cracks in the tarmac within or around aircraft wash racks during aircraft washing. Leaching of contaminants from residual soil contamination to groundwater following precipitation events is unlikely or minimal because the site is virtually covered entirely by tarmac and buildings.
- Downgradient migration of groundwater containing dissolved POL and CVOC contaminants.

CVOC plumes appear to originate from the Building 130 area (including the downgradient fuel lines and the upgradient Building 130 Wash Rack), the C-130 Wash Rack area, Building 4075, and the Former Refueling Station near Building 4495. There are no confirmed pathways from suspected potential CVOC sources to the groundwater at OU14 because CVOCs were not detected or were minimally detected in soil samples above the water table.

Possible pathways to the groundwater may have been leaky drainage and stormwater / sewer pipes and/or spills of chemicals containing CVOCs. There is an interconnected system of stormwater drainage lines (above the water table) throughout the areas of CVOC detections (Figure 2-2). CVOCs may have been introduced via leaky stormwater drainage lines after rainwater flushed wastes from the aircraft wash rack into the system. Likewise, the sanitary and industrial sewer systems each have interconnected lines throughout the area of concern, which may have transported wastewater-containing CVOCs through leaky pipes. It is possible that wastes were flushed from multiple structures, including aircraft maintenance and storage hangars (e.g., Building 130). CVOCs may have entered groundwater through leaky drains or pipes from aircraft wash racks or infiltration through cracks in the pavement within or around aircraft wash racks during aircraft washing.

Precipitation at OU14 travels via sheet flow over the concrete/asphalt paved areas and tarmac to storm drains that discharge to Mill Creek and Slocum Creek, or is evaporated or transpired into the air, with minimal infiltration to the surface of the ground. Infiltration is limited to landscaped areas where there is grass cover and the ground is flat or has only a low slope and to permeation through cracks in paved surfaces. The limited amount of water that does infiltrate to the soil moves by gravity downward through the unsaturated soil. At some depth (generally on the order of 10 to 12 ft bgs), the infiltrating water reaches the water table and enters the shallow groundwater system.

The water table and shallow water-bearing unit (i.e., Upper Surficial Aquifer) at OU14 are located in a predominantly sandy silt material. As the water travels downward into the Lower Surficial Aquifer, the material becomes a coarser-grained silty sand material (Section 2.2.2). The Yorktown Confining Unit is found at a depth of approximately 50 ft bgs, and is an extensive barrier (approximately 20 ft thick) to vertical groundwater flow.

The groundwater flow direction in the Upper Surficial Aquifer is to the northwest, with a turn to the north in the area of Building 4075 (Section 2.2.2; Figure 2-3). Groundwater flow in the Lower Surficial Aquifer is to the north-northwest towards the unnamed stream and ultimately Mill Creek (Section 2.2.2; Figure 2-4). The groundwater gradient is relatively flat, but somewhat variable throughout OU14. South of Building 130, the groundwater shows a mounding effect causing a component of Upper Surficial Aquifer groundwater flow to the south. This mounding appears to be caused by the current UST Program AS/SVE system operating in this area and/or leaky steam pipes (Law Engineering, 1995).

The CVOC transport migration pathway is in accordance with the predominant flow direction of groundwater, which is north to northwest across OU14. Groundwater eventually discharges into the unnamed stream, Mill Creek, Slocum Creek, and ultimately the Neuse River. The chemical properties of the relevant constituents (VOCs, or more specifically, CVOCs for this FS) prevent them from migrating very far at significant concentrations, primarily due to biodegradation rates. The rates of horizontal advective flow in the groundwater system underlying OU14 were estimated to range from 20 to 80 ft/year (averages) in both the Upper and Lower Surficial Aquifers. It should be stressed that these values are estimations of the likely groundwater flow velocities in the groundwater system. The uncertainty in the measurements of hydraulic conductivity and the spatial variability of aquifer properties make it difficult to estimate the average groundwater velocity.

The rates of migration for TCE, VC, and benzene are hardly affected by retardation in the aquifer (retardation coefficients are just over 1), but are significantly affected by natural attenuation mechanisms (degradation, dispersion, dilution, etc.) and the influence of current UST Program remediation systems. The presence of dissolved-phase POL compounds within the Surficial Aquifer (most notably BTEX compounds) is likely facilitating the natural biodegradation of CVOCs by acting as a carbon source for reductive dechlorination.

The RI concluded that the CVOC plumes have stabilized due to natural attenuation processes based on CVOC and POL groundwater data; geochemical and degradation indicator data; non-detect to *de minimis* concentrations of CVOCs and benzene in the unnamed stream; and the elapsed time since the original releases (unknown; assumed to be 30 to 60 years ago). Further evaluation in the RI indicated that groundwater concentrations of TCE, cis-1,2-DCE, and VC found in upgradient areas in excess of NC2L groundwater

standards will not reach the unnamed stream at concentrations above the appropriate NC2B surface water standards (Section 3.4.2) due to biodegradation and other natural attenuation mechanisms.

2.2.6 Summary of Risk Assessments

Human Health Risk Assessment

Soil. Soil was not quantitatively evaluated in the OU14 HHRA because of the following considerations:

- A historical soil data review during work planning showed no CVOC contamination in soil.
- Soil is being investigated and remediated under the MCAS Cherry Point UST Program for the significantly more prevalent POL contamination.
- UST Program and RI data showed minimal site-wide CVOC contamination in soil. CVOC contamination is primarily limited to Surficial Aquifer groundwater, although POL contamination is prevalent throughout OU14 in both soil and groundwater.
- There is little exposed surface soil—OU14 is covered with buildings, concrete, asphalt, taxiways, and a flight line. This severely restricts exposure to subsurface soil and restricts the infiltration of precipitation and potential leaching of soil contaminants to groundwater.

Risk in soil was evaluated conservatively by comparison of soil concentrations to NC SSLs (protection of groundwater criteria). While several POL and metals showed exceedances (presumably unacceptable risk), no CVOCs exceeded the SSLs in the most recent sampling event. Subsequently, no CERCLA risk-drivers were identified as COCs for soil.

Groundwater, Surface Water, and Sediment. Groundwater, surface water, and sediment data were quantitatively evaluated in the Baseline HHRA. The HHRA included a vapor intrusion screening component to evaluate indoor air impacts from VOCs in the groundwater and soil. The HHRA and the vapor intrusion screening evaluated the following exposure scenarios:

- Surficial Aquifer groundwater for future residents and construction workers.
- Indoor air for future residents (semi-quantitative evaluation in the vapor intrusion screening).
- Surface water and sediment for current/future industrial workers and adult and adolescent trespassers/visitors.
- Indoor air for current/future industrial workers (semi-quantitative evaluation in the vapor intrusion screening).

The Yorktown Aquifer groundwater was not evaluated for future residents because no chemicals of potential concern (COPCs) were retained for risk quantification (there were minimal detections in the Yorktown Aquifer).

The Baseline HHRA results indicated that there are no carcinogenic risks or non-carcinogenic hazards above acceptable ranges from exposure to surface water, sediment, or Yorktown Aquifer groundwater. With respect to Surficial Aquifer groundwater, the HHRA results indicated potentially unacceptable risks from exposure for the future adult resident (mainly from iron), future child resident (benzene, arsenic, iron, and manganese), and lifetime resident (VC and arsenic). No risks or hazards above acceptable ranges were identified for the current/future industrial worker. The HHRA concluded that there were no risks or hazards above acceptable ranges for the construction worker; however, several chemicals were retained as COCs for the construction worker based on USEPA Region 4 risk guidance (hazard indexes [HIs] associated with individual body organs; refer to the HHRA in the Final RI Report).

The COCs identified in the HHRA included chemicals, compounds, or other analytes found at the site regardless of whether they were related to a CERCLA release, were being addressed by the UST Program, or were present at concentrations consistent with natural background conditions. Consequently, the list of COCs was refined by the Team to remove several constituents, including benzene, arsenic, iron, and manganese, prior to proceeding with the FS (Section 2.2.7).

Indoor Air Vapor. Based on a comparison of estimated indoor air concentrations to occupational exposure limits (current site usage is industrial [military operations]), the vapor intrusion screening results showed no indication of the need to mitigate vapor issues under current industrial exposure scenarios. The evaluation showed a potential target cancer risk (TCR) greater than 1×10^{-6} from inhalation of estimated vapor concentrations of 1,2-DCA, benzene, TCE, and VC vapors by the current/future industrial worker (onsite workers) and the future resident. However, only estimated benzene vapor concentrations exceeded the upper limit of the USEPA acceptable carcinogenic risk range of 1×10^{-4} and non-carcinogenic hazard index of 1. Because of the nature of screening vapor evaluations, the exceedances were qualified as potentially overstated. No COPCs exceeded the occupational exposure limits—that is, no immediate action is needed for current OU14 site workers or for future workers at any location under current occupational exposure conditions.

The vapor intrusion screening indicated a need for further evaluation of the vapor intrusion pathway in the event that new buildings were constructed or if existing structures were changed significantly. Therefore, indoor air vapor issues will be evaluated in the future, if necessary, prior to construction of new buildings or in the event of a major building modification. Remedial alternatives for groundwater will indirectly address vapor issues, as the potential vapors emanate from the VOCs in groundwater at the site. Land-use controls (LUCs) to address potential indoor air issues are expected to be a component of the selected alternative(s).

Ecological Risk Assessment. No terrestrial habitat was identified at OU14 due to the lack of exposed surface soil. The unnamed stream was determined to be the only viable habitat potentially affected by contaminants in groundwater from OU14. Therefore, surface water and sediment data were evaluated for ecological risks. The screening level ERA concluded that contaminated groundwater is not contributing significant levels of contaminants of potential ecological concern (COPECs) to the aquatic habitat provided by the downgradient

unnamed stream. Therefore, any ecological risks were deemed negligible and no further ecological investigation or action is warranted at OU14.

2.2.7 Contaminants of Concern

Potential risks were identified for exposure to Surficial Aquifer groundwater by a future adult resident, future child resident, future construction worker, and lifetime resident. No unacceptable human health risks were determined for exposure to soil, sediment, surface water, and Yorktown Aquifer groundwater at OU14. In addition, a screening vapor intrusion evaluation conservatively estimated potential risk to current/future industrial workers (onsite workers) and future residents from exposure to indoor air vapor from POL and CVOC groundwater contaminants. However, the vapor intrusion screening results showed no indication of the need to mitigate vapor issues under current industrial exposure scenarios. No unacceptable ecological risks were determined for OU14.

A COC is defined as any COPC that contributes significant risks to a pathway in a use scenario for a receptor. USEPA Region 4 classifies any COPC with a cancer risk greater than 10^{-6} and/or a non-cancer hazard quotient greater than 0.1 (where the cumulative cancer risk is greater than 10^{-4} and/or the HI is greater than 1) as a COC. Following this guidance, several Surficial Aquifer groundwater COCs were initially identified based on the HHRA results, and Remedial Goal Options (RGOs) at TCRs of 10^{-4}, 10^{-5}, and 10^{-6} and target HIs of 3.0, 1.0, and 0.1 were calculated for each COC (*Table 7-6 in the HHRA in the OU14 RI*).

The Team reviewed the risk-drivers in the Surficial Aquifer identified in the HHRA to determine which chemicals would be forwarded to the FS as COCs for remedial alternative evaluation under the CERCLA process. POL compounds (investigated and managed by the UST Program) and naturally occurring and/or human nutrient inorganic constituents were specifically excluded as COCs because they are not related to historical CERCLA releases at OU14. In addition, the Team agreed that CERCLA-release chemicals exceeding NC2L groundwater standards would be forwarded as CERCLA COCs (per NC anti-degradation ARARs). Table 2-1a shows the COCs for Surficial Aquifer groundwater grouped by NC2L exceedance and human receptor. Table 2-1b summarizes the COCs. Cleanup goals, or PRGs, are determined in Section 3.

2.2.8 RI Recommendations

The RI recommended performing an FS (described herein) to evaluate remedial alternatives to address the potential human health risks related to CERCLA COCs in the Surficial Aquifer (Section 2.2.7). Several groundwater COCs were identified for the hypothetical future potable use scenario—some of these showed a potential vapor issue for hypothetical future residents and workers. If worker conditions changed due to future building modifications or new construction, a potential vapor issue could result. Thus, indoor air vapor issues will be evaluated in the future, if necessary, prior to the construction of new buildings or in the event of a major modification to an existing building. Remedial alternatives to address CVOCs in groundwater would indirectly address vapor issues. Potential remedial actions to address POL contamination are under the purview of the UST Program.

The UST Program monitors vapors in utility vaults and some small structures throughout OU14, but cannot mitigate POL vapor problems until POL free-phase product is removed throughout the site. Once FP is removed, the UST Program will address any POL vapor issues, if present, which may or may not also address potential CVOC vapor issues, depending on whether engineering controls versus remediation of VOCs in groundwater has been implemented. Engineering controls such as blowers and ventilation systems in buildings would address all vapor issues. However, an active remediation system to address POL contamination in groundwater (to mitigate vapor issues), such as aerobic biodegradation, might not address CVOC groundwater contamination (or vapor); whereas, air sparging and SVE systems would address both POL and CVOC groundwater contamination and subsequently mitigate vapor issues for both CVOCs and POL compounds.

The default remedy for mitigating potential future vapor intrusion risk (i.e., remediating for a future industrial or residential vapor intrusion scenarios) is to remediate the groundwater containing the chemicals presumably causing the future vapor intrusion issue(s). Otherwise, engineering controls may need to be implemented at the time of construction. The intent of any groundwater remedy to be implemented at OU14 (evaluated herein) will be to decrease COC concentrations to allow for potable use and comply with NC anti-degradation ARARs. This will eliminate the need for remediating groundwater strictly to address indoor vapor—that is, meeting NC2L groundwater standards, or the remediation goals (refer to Section 4), is expected to result in no unacceptable vapor intrusion issue(s).

Table 2-1a
Comprehensive List of COCs - Surficial Aquifer Groundwater
Operable Unit 14, Site 90 Feasibility Study
MCAS Cherry Point, North Carolina

COC forwarded from the RI to the FS due to NC2L exceedance
1,1-Dichloroethane
Chloromethane
Methylene Chloride
COC forwarded from the RI to the FS based on results of the HHRA
Residential Adult
None
Residential Child
1,2-Dichloroethane
Vinyl chloride
cis-1,2-Dichloroethene
Trichloroethene
Lifetime Adult/Child Resident
1,2-Dichloroethane
Tetrachloroethene
Trichloroethene
Vinyl chloride
Construction Worker Adult
1,2-Dichloroethane
Bromomethane

Notes

The Baseline Human Health Risk Assessment (HHRA) is in the Final OU14 Remedial Investigation Report (CH2M HILL, 2008).
NC2L – North Groundwater Standards as defined in North Carolina Administrative Code Title 15A, Subchapter 2L, "Class GA" (May 2005)
HHRA - Baseline Human Health Risk Assessment performed during the Remedial Investigation

Table 2-1b
Summary of OU14 FS COCs - Surficial Aquifer Groundwater
Operable Unit 14, Site 90 Feasibility Study
MCAS Cherry Point, North Carolina

1,1-Dichloroethane (1,1-DCA)
1,2-Dichloroethane (1,2-DCA)
Bromomethane
Chloromethane
Cis-1,2-dichloroethene (cis-1,2-DCE)
Methylene Chloride
Tetrachloroethene (PCE)
Trichloroethene (TCE)
Vinyl chloride (VC)

\\aphrodite\Proj\USNavFacEngCom\CherryPoint\Projects\OU14_FS\Figure 2-1 - Location Map_revised.mxd

MCAS Cherry Point UST Program free product (FP) recovery wells are present throughout OU14. Some monitoring wells are also used for FP recovery. Refer to the UST Program figures in Appendix B of the CH2M HILL (2008) OU14 RI Report. Also refer to Appendix L in the RI Report for as-built drawings of the UST Program's active treatment systems throughout OU14 (also included in Appendix A of this FS Report). These systems include air sparge, soil vapor extraction (SVE), and FP recovery.

Legend

- Approximate ERP Site 90 Boundary
- Approximate extent of area treated by the MCAS Cherry Point UST Program's "Building 4075 Treatment System"
- Surface Water

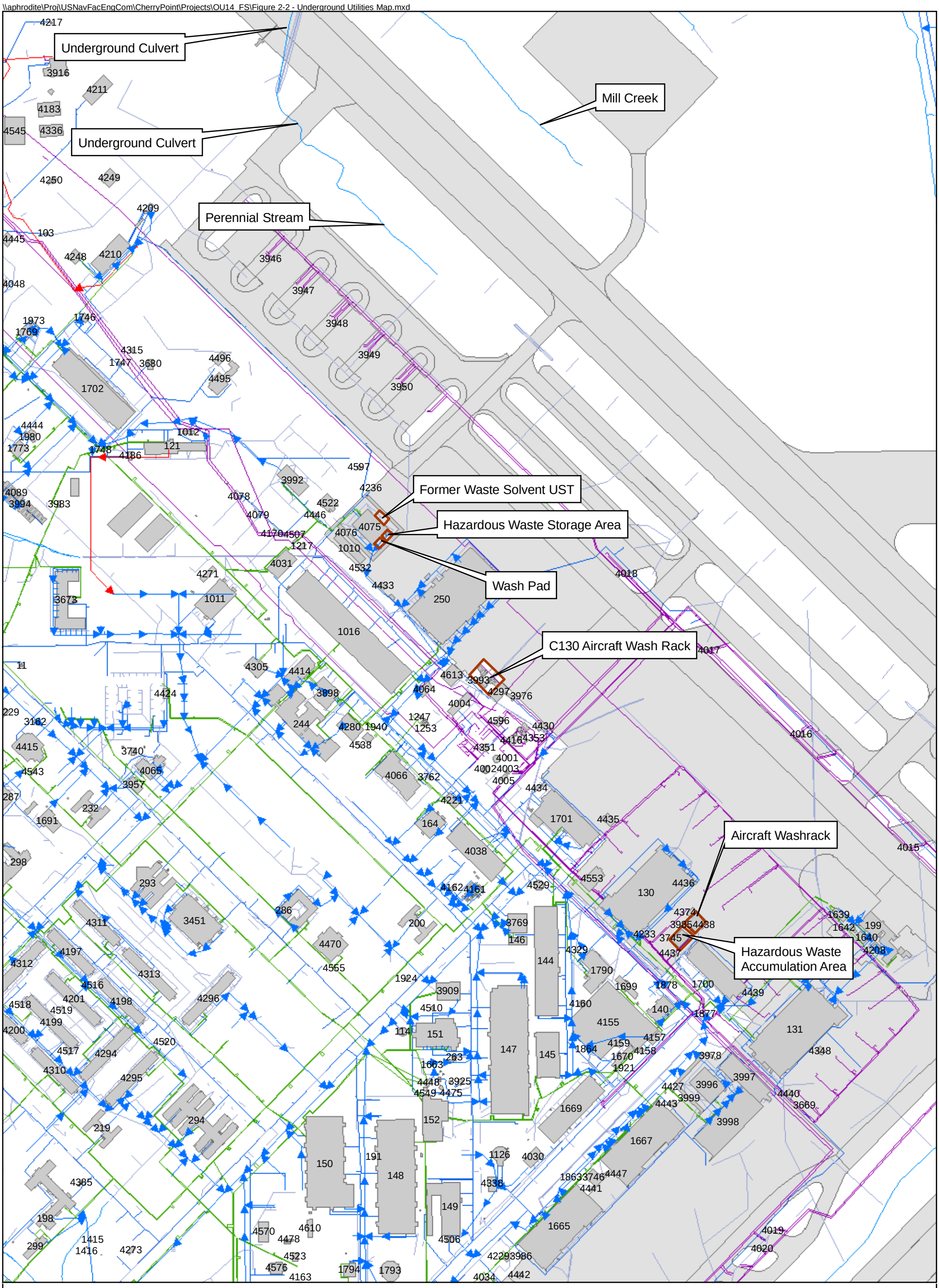
N
W E
S

0 500 1,000 Feet

Figure 2-1
OU14 Site Features
Operable Unit 14, Site 90 Feasibility Study
MCAS Cherry Point
North Carolina

CH2MHILL

\\aphrodite\Proj\USNavFacEngCom\CherryPoint\Projects\OU14_FS\Figure 2-2 - Underground Utilities Map.mxd



Legend

- Force Main
- Gravity Main
- Buildings
- Fuel Line
- Heating and Cooling Line
- Storm Sewer Line
- Water Line
- Airfield Surface

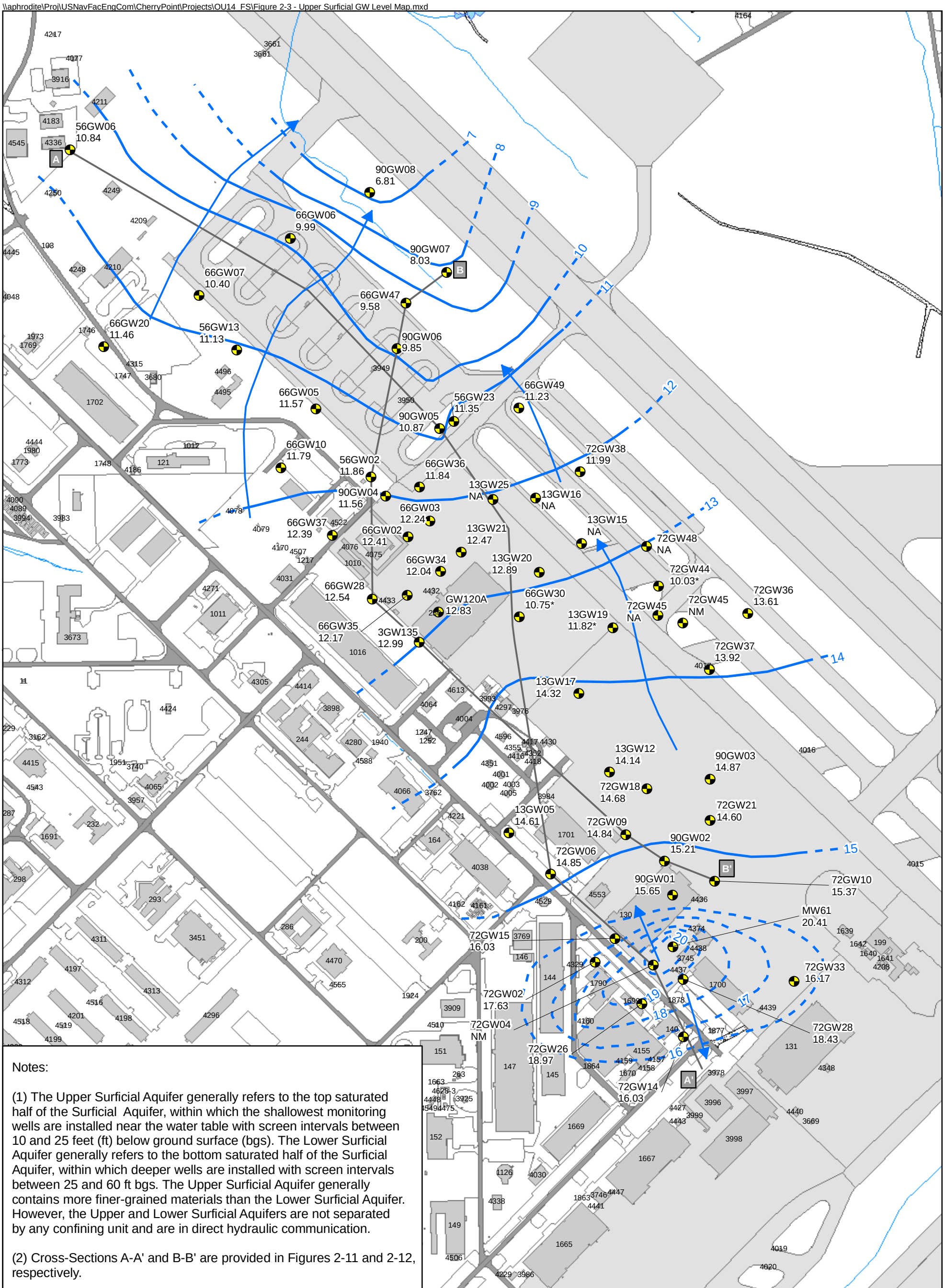
N W E S

0 250 500 Feet

Figure 2-2
Underground Utilities at OU14
Operable Unit 14, Site 90 Feasibility Study
MCAS Cherry Point
North Carolina

CH2MHILL

\\aphrodite\Proj\USNavFacEngCom\CherryPoint\Projects\OU14_FS\Figure 2-3 - Upper Surficial GW Level Map.mxd



Notes:

(1) The Upper Surficial Aquifer generally refers to the top saturated half of the Surficial Aquifer, within which the shallowest monitoring wells are installed near the water table with screen intervals between 10 and 25 feet (ft) below ground surface (bgs). The Lower Surficial Aquifer generally refers to the bottom saturated half of the Surficial Aquifer, within which deeper wells are installed with screen intervals between 25 and 60 ft bgs. The Upper Surficial Aquifer generally contains more finer-grained materials than the Lower Surficial Aquifer. However, the Upper and Lower Surficial Aquifers are not separated by any confining unit and are in direct hydraulic communication.

(2) Cross-Sections A-A' and B-B' are provided in Figures 2-11 and 2-12, respectively.

Legend

- Upper Surficial Aquifer Monitoring Well
- Groundwater Contours (inferred)
- Groundwater Contours
- Surface Water
- Transect
- Buildings
- Groundwater Flow Direction
- 15.85 Groundwater Elevation in ft. amsl
- NM Not Measured

* Anomalous groundwater data in well 13GW19, 66GW30, and 72GW44. Groundwater data not used to generate Lower Surficial Aquifer groundwater elevation contours. It is not clear why the groundwater level in this well is higher than expected, but may be due to delayed equilibration.

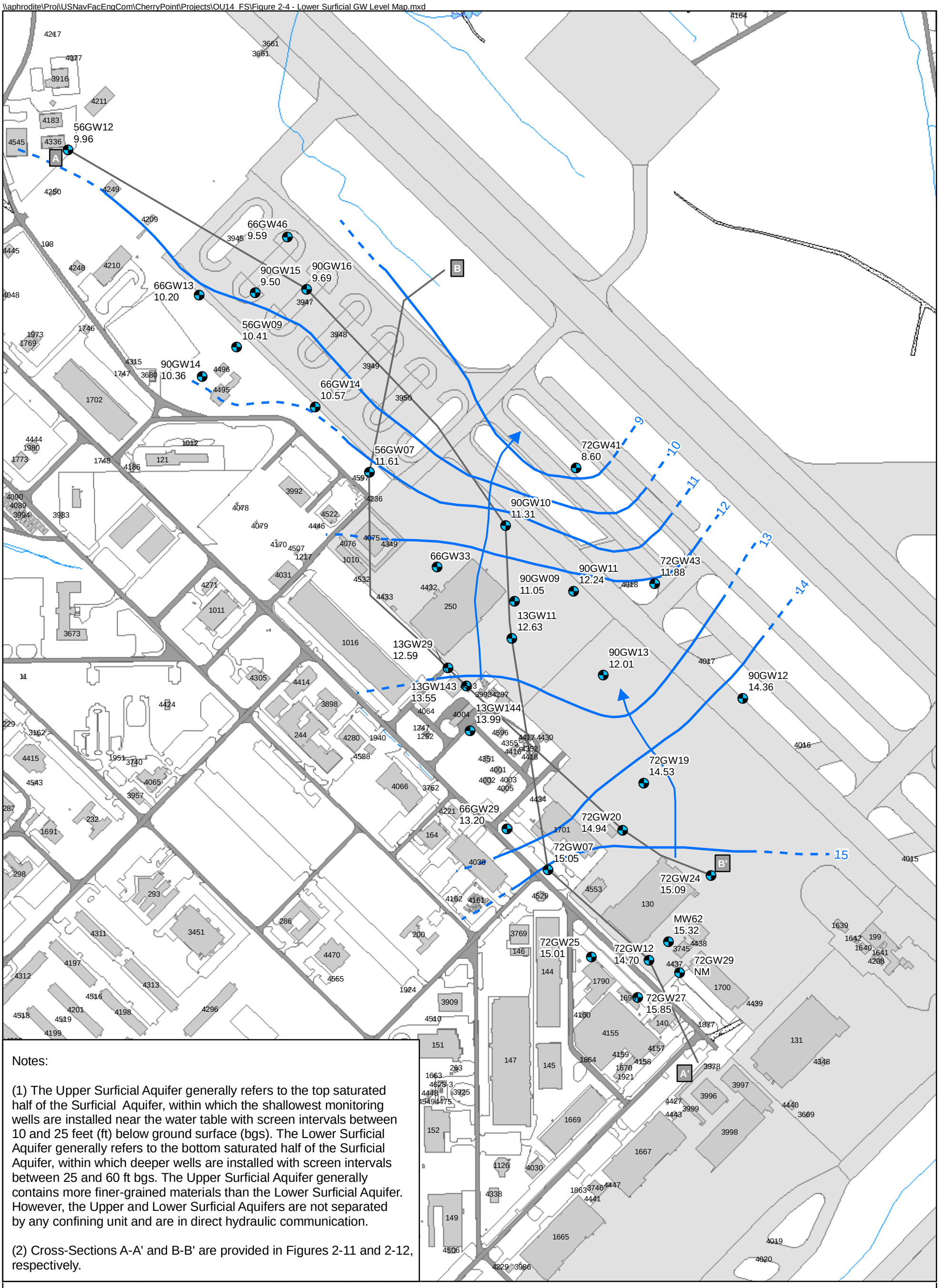
N W E S

0 250 500 Feet

Figure 2-3
Upper Surficial Aquifer
Water Level Map (April 14, 2005)
Operable Unit 14, Site 90 Feasibility Study
MCAS Cherry Point, North Carolina

CH2MHILL

\\aphrodite\Proj\USNavFacEngCom\CherryPoint\Projects\OU14_FS\Figure 2-4 - Lower Surficial GW Level Map.mxd



Notes:

(1) The Upper Surficial Aquifer generally refers to the top saturated half of the Surficial Aquifer, within which the shallowest monitoring wells are installed near the water table with screen intervals between 10 and 25 feet (ft) below ground surface (bgs). The Lower Surficial Aquifer generally refers to the bottom saturated half of the Surficial Aquifer, within which deeper wells are installed with screen intervals between 25 and 60 ft bgs. The Upper Surficial Aquifer generally contains more finer-grained materials than the Lower Surficial Aquifer. However, the Upper and Lower Surficial Aquifers are not separated by any confining unit and are in direct hydraulic communication.

(2) Cross-Sections A-A' and B-B' are provided in Figures 2-11 and 2-12, respectively.

Legend

- Lower Surficial Aquifer Monitoring Well
- Groundwater Contours (Inferred)
- Groundwater Contours
- Transect
- Surface Water
- Buildings
- Groundwater Flow Direction
- 15.85 Groundwater Elevation in ft. amsl
- NM Not Measured

* Anomalous groundwater data in well 72GW12. Groundwater data not used to generate Lower Surficial Aquifer groundwater elevation contours. It is not clear why the groundwater level in this well is higher than expected, but may be due to delayed equilibration.

N W E S

0 250 500 Feet

Figure 2-4
Lower Surficial Aquifer
Water Level Map (April 14, 2005)
Operable Unit 14, Site 90 Feasibility Study
MCAS Cherry Point, North Carolina

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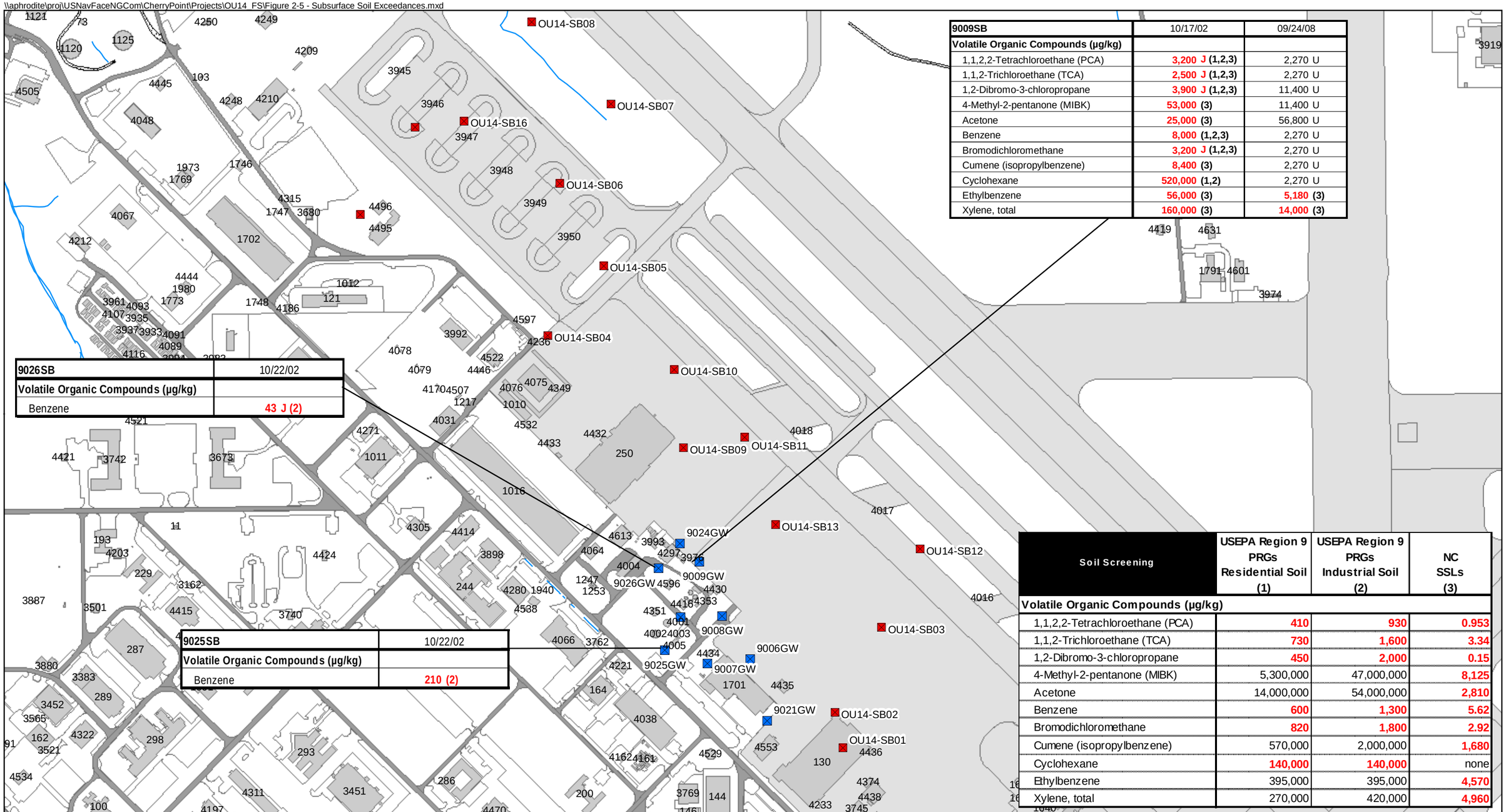
\\aphrodite\proj\USNavFaceNGCom\CherryPoint\Projects\OU14_FS\Figure 2-5 - Subsurface Soil Exceedances.mxd



9009SB	10/17/02	09/24/08
Volatile Organic Compounds (µg/kg)		
1,1,2,2-Tetrachloroethane (PCA)	3,200 J (1,2,3)	2,270 U
1,1,2-Trichloroethane (TCA)	2,500 J (1,2,3)	2,270 U
1,2-Dibromo-3-chloropropane	3,900 J (1,2,3)	11,400 U
4-Methyl-2-pentanone (MIBK)	53,000 (3)	11,400 U
Acetone	25,000 (3)	56,800 U
Benzene	8,000 (1,2,3)	2,270 U
Bromodichloromethane	3,200 J (1,2,3)	2,270 U
Cumene (isopropylbenzene)	8,400 (3)	2,270 U
Cyclohexane	520,000 (1,2)	2,270 U
Ethylbenzene	56,000 (3)	5,180 (3)
Xylene, total	160,000 (3)	14,000 (3)

9026SB	10/22/02
Volatile Organic Compounds (µg/kg)	
Benzene	43 J (2)

9025SB	10/22/02
Volatile Organic Compounds (µg/kg)	
Benzene	210 (2)

Soil Screening	USEPA Region 9 PRGs Residential Soil (1)	USEPA Region 9 PRGs Industrial Soil (2)	NC SSLs (3)
Volatile Organic Compounds (µg/kg)			
1,1,2,2-Tetrachloroethane (PCA)	410	930	0.953
1,1,2-Trichloroethane (TCA)	730	1,600	3.34
1,2-Dibromo-3-chloropropane	450	2,000	0.15
4-Methyl-2-pentanone (MIBK)	5,300,000	47,000,000	8,125
Acetone	14,000,000	54,000,000	2,810
Benzene	600	1,300	5.62
Bromodichloromethane	820	1,800	2.92
Cumene (isopropylbenzene)	570,000	2,000,000	1,680
Cyclohexane	140,000	140,000	none
Ethylbenzene	395,000	395,000	4,570
Xylene, total	270,000	420,000	4,960

Legend

- Subsurface Soil Sample Location (2002/2008)
- Subsurface Soil Sample Location (2005)
- Surface Water

Each screening criteria has been assigned a reference number listed in the column header.
The reference number is used to identify specific criteria exceeded in a particular sample.
Only locations with exceedances have textboxes.
No sample was collected at OU14-SB07 during the installation of monitoring well 90GW07.

VOC - Volatile Organic Compound
µg/L - micrograms per liter
J - Estimated
PRG - Preliminary Remediation Goal
NC SSL - North Carolina Soil Screening Level

N W E S

0 250 500 Feet

Figure 2-5
Subsurface Soil Exceedances of RI Screening Values
Operable Unit 14 Feasibility Study
MCAS Cherry Point
North Carolina

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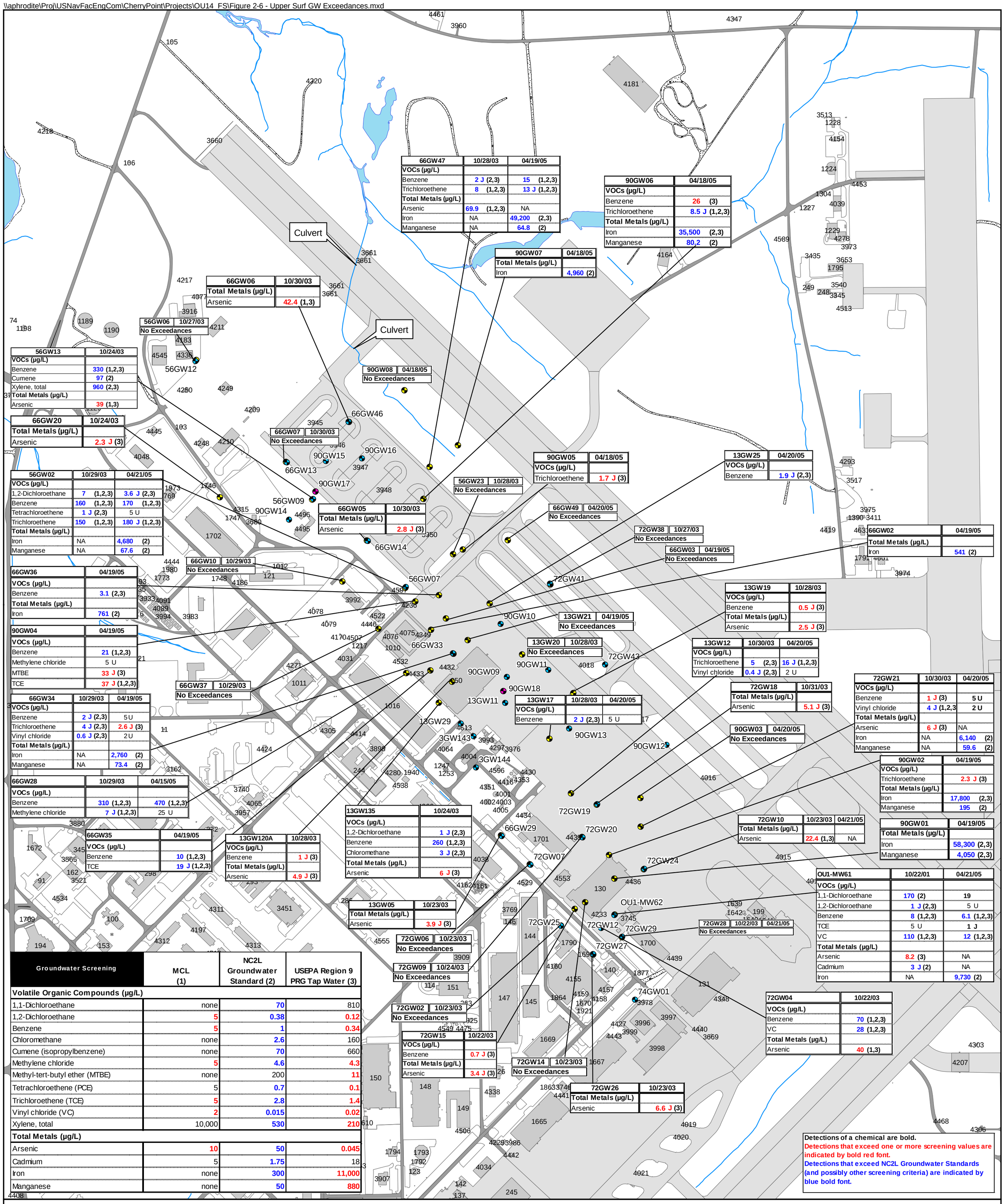
\\aphrodite\Proj\USNavFacEngCom\CherryPoint\Projects\OU14_FS\Figure 2-6 - Upper Surf GW Exceedances.mxd



66GW47	10/28/03	04/19/05
VOCs (µg/L)		
Benzene	2 J (2,3)	15 (1,2,3)
Trichloroethene	8 (1,2,3)	13 J (1,2,3)
Total Metals (µg/L)		
Arsenic	69.9 (1,2,3)	NA
Iron	NA	49,200 (2,3)
Manganese	NA	64.8 (2)

90GW06	04/18/05
VOCs (µg/L)	
Benzene	26 (3)
Trichloroethene	8.5 J (1,2,3)
Total Metals (µg/L)	
Iron	35,500 (2,3)
Manganese	80.2 (2)

90GW07	04/18/05
Total Metals (µg/L)	
Iron	4,960 (2)

66GW06	10/30/03
Total Metals (µg/L)	
Arsenic	42.4 (1,3)

56GW06	10/27/03
No Exceedances	

56GW13	10/24/03
VOCs (µg/L)	
Benzene	330 (1,2,3)
Cumene	97 (2)
Xylene, total	960 (2,3)
Total Metals (µg/L)	
Arsenic	39 (1,3)

90GW08	04/18/05
No Exceedances	

66GW20	10/24/03
Total Metals (µg/L)	
Arsenic	2.3 J (3)

66GW07	10/30/03
No Exceedances	

56GW02	10/29/03	04/21/05
VOCs (µg/L)		
1,2-Dichloroethane	7 (1,2,3)	3.6 J (2,3)
Benzene	160 (1,2,3)	170 (1,2,3)
Tetrachloroethene	1 J (2,3)	5 U
Trichloroethene	150 (1,2,3)	180 J (1,2,3)
Total Metals (µg/L)		
Iron	NA	4,680 (2)
Manganese	NA	67.6 (2)

66GW05	10/30/03
Total Metals (µg/L)	
Arsenic	2.8 J (3)

56GW23	10/28/03
No Exceedances	

90GW05	04/18/05
VOCs (µg/L)	
Trichloroethene	1.7 J (3)

13GW25	04/20/05
VOCs (µg/L)	
Benzene	1.9 J (2,3)

66GW49	04/20/05
No Exceedances	

72GW38	10/27/03
No Exceedances	

66GW03	04/19/05
No Exceedances	

66GW02	04/19/05
Total Metals (µg/L)	
Iron	541 (2)

66GW36	04/19/05
VOCs (µg/L)	
Benzene	3.1 (2,3)
Total Metals (µg/L)	
Iron	761 (2)

66GW10	10/29/03
No Exceedances	

13GW19	10/28/03
VOCs (µg/L)	
Benzene	0.5 J (3)
Total Metals (µg/L)	
Arsenic	2.5 J (3)

90GW04	04/19/05
VOCs (µg/L)	
Benzene	21 (1,2,3)
Methylene chloride	5 U
MTBE	33 J (3)
TCE	37 J (1,2,3)

13GW21	04/19/05
No Exceedances	

13GW20	10/28/03
No Exceedances	

13GW12	10/30/03	04/20/05
VOCs (µg/L)		
Trichloroethene	5 (2,3)	16 J (1,2,3)
Vinyl chloride	0.4 J (2,3)	2 U

66GW37	10/29/03
No Exceedances	

72GW18	10/31/03
Total Metals (µg/L)	
Arsenic	5.1 J (3)

72GW21	10/30/03	04/20/05
VOCs (µg/L)		
Benzene	1 J (3)	5 U
Vinyl chloride	4 J (1,2,3	2 U
Total Metals (µg/L)		
Arsenic	6 J (3)	NA
Iron	NA	6,140 (2)
Manganese	NA	59.6 (2)

66GW34	10/29/03	04/19/05
VOCs (µg/L)		
Benzene	2 J (2,3)	5 U
Trichloroethene	4 J (2,3)	2.6 J (3)
Vinyl chloride	0.6 J (2,3)	2 U
Total Metals (µg/L)		
Iron	NA	2,760 (2)
Manganese	NA	73.4 (2)

13GW17	10/28/03	04/20/05
VOCs (µg/L)		
Benzene	2 J (2,3)	5 U

90GW03	04/20/05
No Exceedances	

90GW02	04/19/05
VOCs (µg/L)	
Trichloroethene	2.3 J (3)
Total Metals (µg/L)	
Iron	17,800 (2,3)
Manganese	195 (2)

66GW28	10/29/03	04/15/05
VOCs (µg/L)		
Benzene	310 (1,2,3)	470 (1,2,3)
Methylene chloride	7 J (1,2,3)	25 U

13GW135	10/24/03
VOCs (µg/L)	
1,2-Dichloroethane	1 J (2,3)
Benzene	260 (1,2,3)
Chloromethane	3 J (2,3)
Total Metals (µg/L)	
Arsenic	6 J (3)

72GW10	10/23/03	04/21/05
Total Metals (µg/L)		
Arsenic	22.4 (1,3)	NA

90GW01	04/19/05
Total Metals (µg/L)	
Iron	58,300 (2,3)
Manganese	4,050 (2,3)

66GW35	04/19/05
VOCs (µg/L)	
Benzene	10 (1,2,3)
TCE	19 J (1,2,3)

13GW120A	10/28/03
VOCs (µg/L)	
Benzene	1 J (3)
Total Metals (µg/L)	
Arsenic	4.9 J (3)

OU1-MW61	10/22/01	04/21/05
VOCs (µg/L)		
1,1-Dichloroethane	170 (2)	19
1,2-Dichloroethane	1 J (2,3)	5 U
Benzene	8 (1,2,3)	6.1 (1,2,3)
TCE	5 U	1 J
VC	110 (1,2,3)	12 (1,2,3)
Total Metals (µg/L)		
Arsenic	8.2 (3)	NA
Cadmium	3 J (2)	NA
Iron	NA	9,730 (2)

13GW05	10/23/03
Total Metals (µg/L)	
Arsenic	3.9 J (3)

72GW28	10/22/03	04/21/05
No Exceedances		

72GW06	10/23/03
No Exceedances	

72GW09	10/24/03
No Exceedances	

72GW04	10/22/03
VOCs (µg/L)	
Benzene	70 (1,2,3)
VC	28 (1,2,3)
Total Metals (µg/L)	
Arsenic	40 (1,3)

72GW02	10/23/03
No Exceedances	

72GW15	10/22/03
VOCs (µg/L)	
Benzene	0.7 J (3)
Total Metals (µg/L)	
Arsenic	3.4 J (3)

72GW14	10/23/03
No Exceedances	

72GW26	10/23/03
Total Metals (µg/L)	
Arsenic	6.6 J (3)

Groundwater Screening	MCL (1)	NC2L Groundwater Standard (2)	USEPA Region 9 PRG Tap Water (3)
Volatile Organic Compounds (µg/L)			
1,1-Dichloroethane	none	70	810
1,2-Dichloroethane	5	0.38	0.12
Benzene	5	1	0.34
Chloromethane	none	2.6	160
Cumene (isopropylbenzene)	none	70	660
Methylene chloride	5	4.6	4.3
Methyl-tert-butyl ether (MTBE)	none	200	11
Tetrachloroethene (PCE)	5	0.7	0.1
Trichloroethene (TCE)	5	2.8	1.4
Vinyl chloride (VC)	2	0.015	0.02
Xylene, total	10,000	530	210
Total Metals (µg/L)			
Arsenic	10	50	0.045
Cadmium	5	1.75	18
Iron	none	300	11,000
Manganese	none	50	880

Detections of a chemical are bold.
Detections that exceed one or more screening values are indicated by bold red font.
Detections that exceed NC2L Groundwater Standards (and possibly other screening criteria) are indicated by blue bold font.

Legend

- Upper Surficial Aquifer Monitoring Well
- Lower Surficial Aquifer Monitoring Well
- Yorktown Aquifer Monitoring Well
- Existing Buildings
- Permanent Water Body
- Surface Water

Each screening criteria has been assigned a reference number listed in parenthesis in the column header. The reference number is used to identify specific criteria exceeded in a particular sample.

NA - Not analyzed
U - Analyte not detected
J - Reported value is estimated
VOCs - Volatile Organic Compounds
MCL - Maximum Contaminant Level
PRGs - Preliminary Remediation Goals
NC2L GW - North Carolina Groundwater Quality Standards
µg/L - micrograms per liter

N W E S

0 250 500 Feet

Figure 2-6
Groundwater Exceedances of RI Screening Values
Upper Surficial Aquifer
Operable Unit 14, Site 90 Feasibility Study
MCAS Cherry Point
North Carolina

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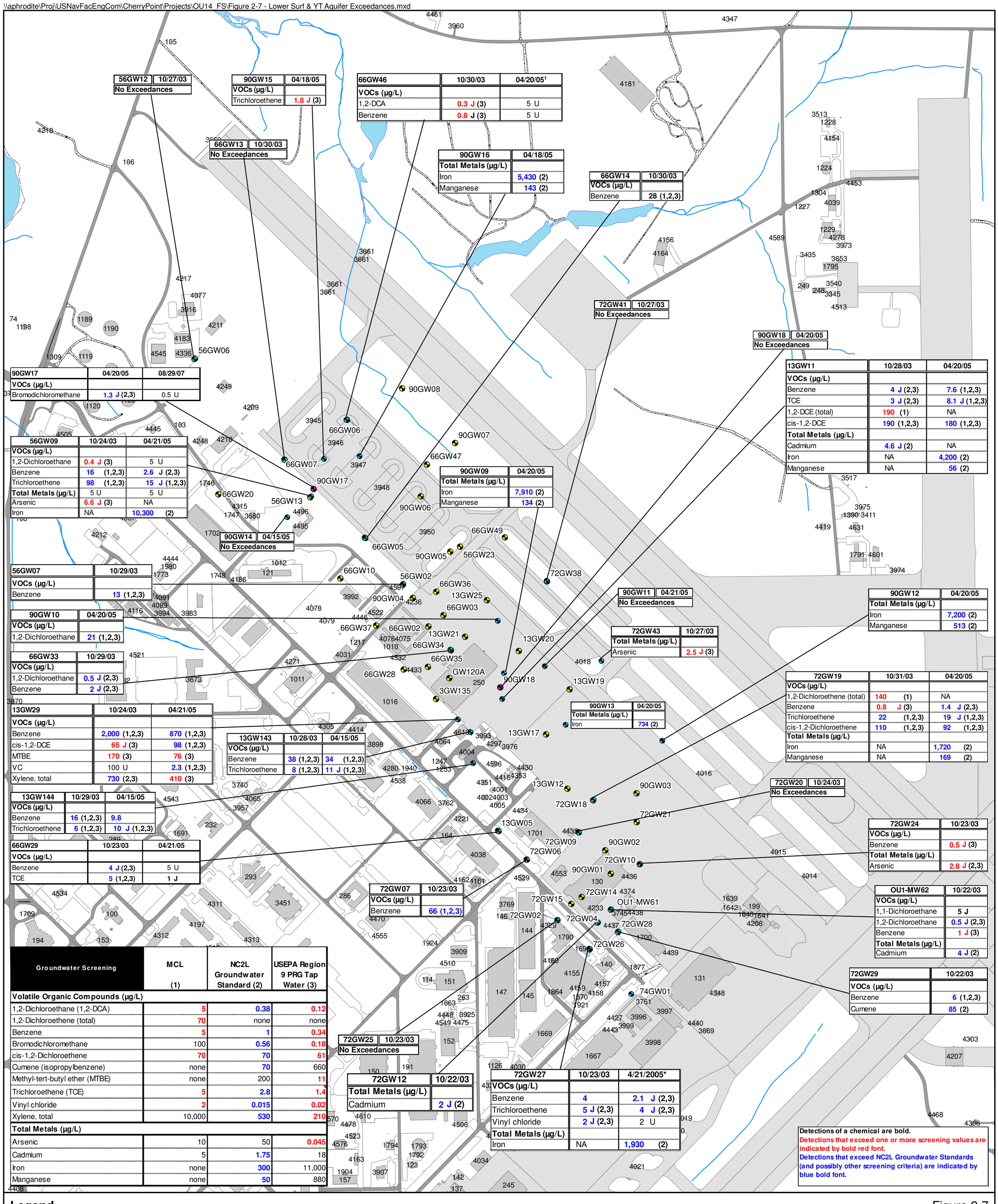
\\aphrodite\Proj\USNavFacEngCom\CherryPoint\Projects\OU14_FS\Figure 2-7 - Lower Surf & YT Aquifer Exceedances.mxd



Groundwater Screening	MCL (1)	NC2L Groundwater Standard (2)	USEPA Region 9 PRG Tap Water (3)
Volatile Organic Compounds (µg/L)			
1,2-Dichloroethane (1,2-DCA)	5	0.38	0.12
1,2-Dichloroethene (total)	70	none	none
Benzene	5	1	0.34
Bromodichloromethane	100	0.56	0.18
cis-1,2-Dichloroethene	70	70	61
Cumene (isopropylbenzene)	none	70	660
Methyl-tert-butyl ether (MTBE)	none	200	11
Trichloroethene (TCE)	5	2.8	1.4
Vinyl chloride	2	0.015	0.02
Xylene, total	10,000	530	210
Total Metals (µg/L)			
Arsenic	10	50	0.045
Cadmium	5	1.75	18
Iron	none	300	11,000
Manganese	none	50	880

Legend

- Upper Surficial Aquifer Monitoring Well
- Lower Surficial Aquifer Monitoring Well; 74GW01
- Yorktown Aquifer Monitoring Well
- Existing Buildings
- Permanent Water Body
- Surface Water

Each screening criteria has been assigned a reference number listed in parenthesis in the column header. The reference number is used to identify specific criteria exceeded in a particular sample.

NA - Not analyzed
U - Analyte not detected
J - Reported value is estimated
VOCs - Volatile Organic Compounds
MCL - Maximum Contaminant Level
PRGs - Preliminary Remediation Goals
NC2L GW - North Carolina Groundwater Quality Standards
µg/L - micrograms per liter

N W E S

0 250 500 Feet

Figure 2-7
Groundwater Exceedances of RI Screening Values
Lower Surficial Aquifer and Yorktown Aquifer
Operable Unit 14, Site 90 Feasibility Study
MCAS Cherry Point
North Carolina

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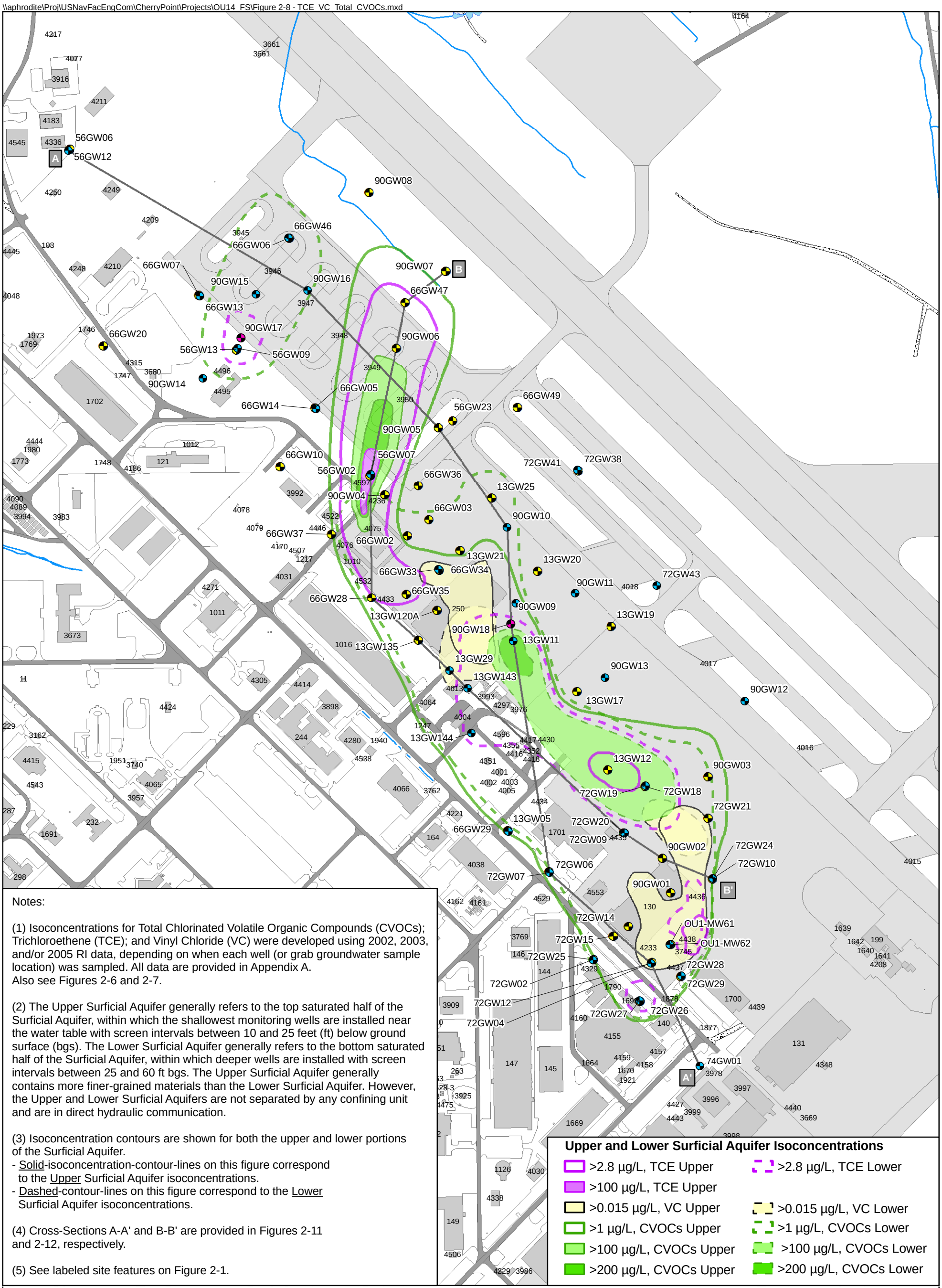
\\aphrodite\Proj\USNavFacEngCom\CherryPoint\Projects\OU14_FS\Figure 2-8 - TCE_VC_Total_CVOCs.mxd



Notes:

(1) Isoconcentrations for Total Chlorinated Volatile Organic Compounds (CVOCs); Trichloroethene (TCE); and Vinyl Chloride (VC) were developed using 2002, 2003, and/or 2005 RI data, depending on when each well (or grab groundwater sample location) was sampled. All data are provided in Appendix A.
Also see Figures 2-6 and 2-7.

(2) The Upper Surficial Aquifer generally refers to the top saturated half of the Surficial Aquifer, within which the shallowest monitoring wells are installed near the water table with screen intervals between 10 and 25 feet (ft) below ground surface (bgs). The Lower Surficial Aquifer generally refers to the bottom saturated half of the Surficial Aquifer, within which deeper wells are installed with screen intervals between 25 and 60 ft bgs. The Upper Surficial Aquifer generally contains more finer-grained materials than the Lower Surficial Aquifer. However, the Upper and Lower Surficial Aquifers are not separated by any confining unit and are in direct hydraulic communication.

(3) Isoconcentration contours are shown for both the upper and lower portions of the Surficial Aquifer.
- Solid-isoconcentration-contour-lines on this figure correspond to the Upper Surficial Aquifer isoconcentrations.
- Dashed-contour-lines on this figure correspond to the Lower Surficial Aquifer isoconcentrations.

(4) Cross-Sections A-A' and B-B' are provided in Figures 2-11 and 2-12, respectively.

(5) See labeled site features on Figure 2-1.

Upper and Lower Surficial Aquifer Isoconcentrations

>2.8 µg/L, TCE Upper	>2.8 µg/L, TCE Lower
>100 µg/L, TCE Upper	
>0.015 µg/L, VC Upper	>0.015 µg/L, VC Lower
>1 µg/L, CVOCs Upper	>1 µg/L, CVOCs Lower
>100 µg/L, CVOCs Upper	>100 µg/L, CVOCs Lower
>200 µg/L, CVOCs Upper	>200 µg/L, CVOCs Lower

Legend
- Lower Surficial Aquifer Monitoring Well
- Yorktown Aquifer Monitoring Well
- Upper Surficial Aquifer Monitoring Well
- Transect for Cross-Section
- Surface Water

N W E S

0 250 500 Feet

Figure 2-8
Trichloroethene, Vinyl Chloride, and Total CVOCs
Upper and Lower Surficial Aquifer (Combined)
Operable Unit 14, Site 90 Feasibility Study
MCAS Cherry Point
North Carolina

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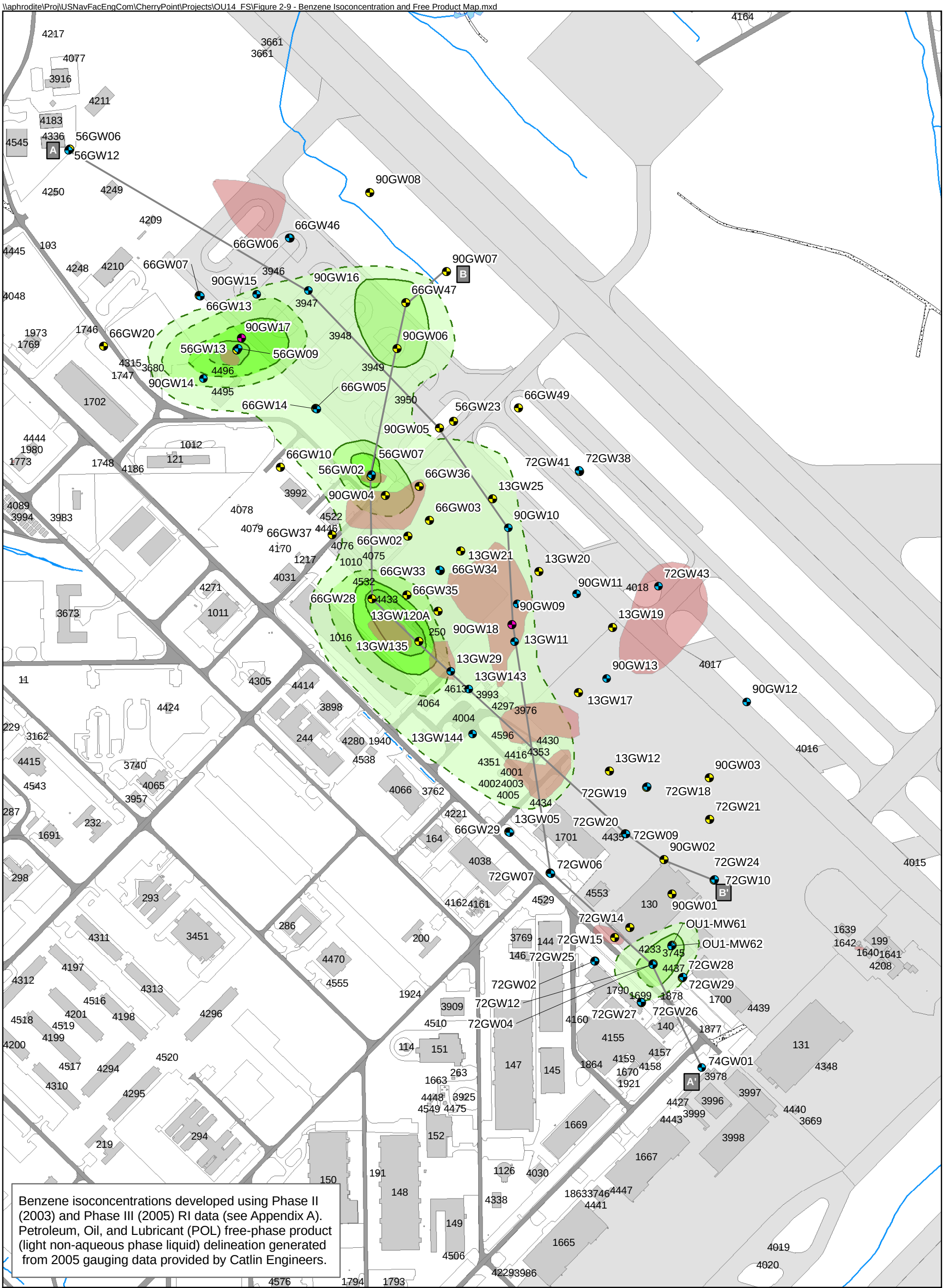
\\aphrodite\Proj\USNavFacEngCom\CherryPoint\Projects\OU14_FS\Figure 2-9 - Benzene Isoconcentration and Free Product Map.mxd



Benzene isoconcentrations developed using Phase II (2003) and Phase III (2005) RI data (see Appendix A). Petroleum, Oil, and Lubricant (POL) free-phase product (light non-aqueous phase liquid) delineation generated from 2005 gauging data provided by Catlin Engineers.

Legend

- Upper Surficial Aquifer Monitoring Well
- Lower Surficial Aquifer Monitoring Well
- Yorktown Aquifer Monitoring Well
- Transect
- Surface Water
- Isoconcetration Contour (Inferred)
- Isoconcetration Contour
- POL Free Product

Benzene Isoconcentration Shading

- 1-5 µg/L
- 5-100 µg/L
- 100-200 µg/L
- > 200 µg/L

N W E S

0 250 500 Feet

Figure 2-9
Benzene in Groundwater and POL Free Product
Upper Surficial Aquifer
Operable Unit 14, Site 90 Feasibility Study
MCAS Cherry Point
North Carolina

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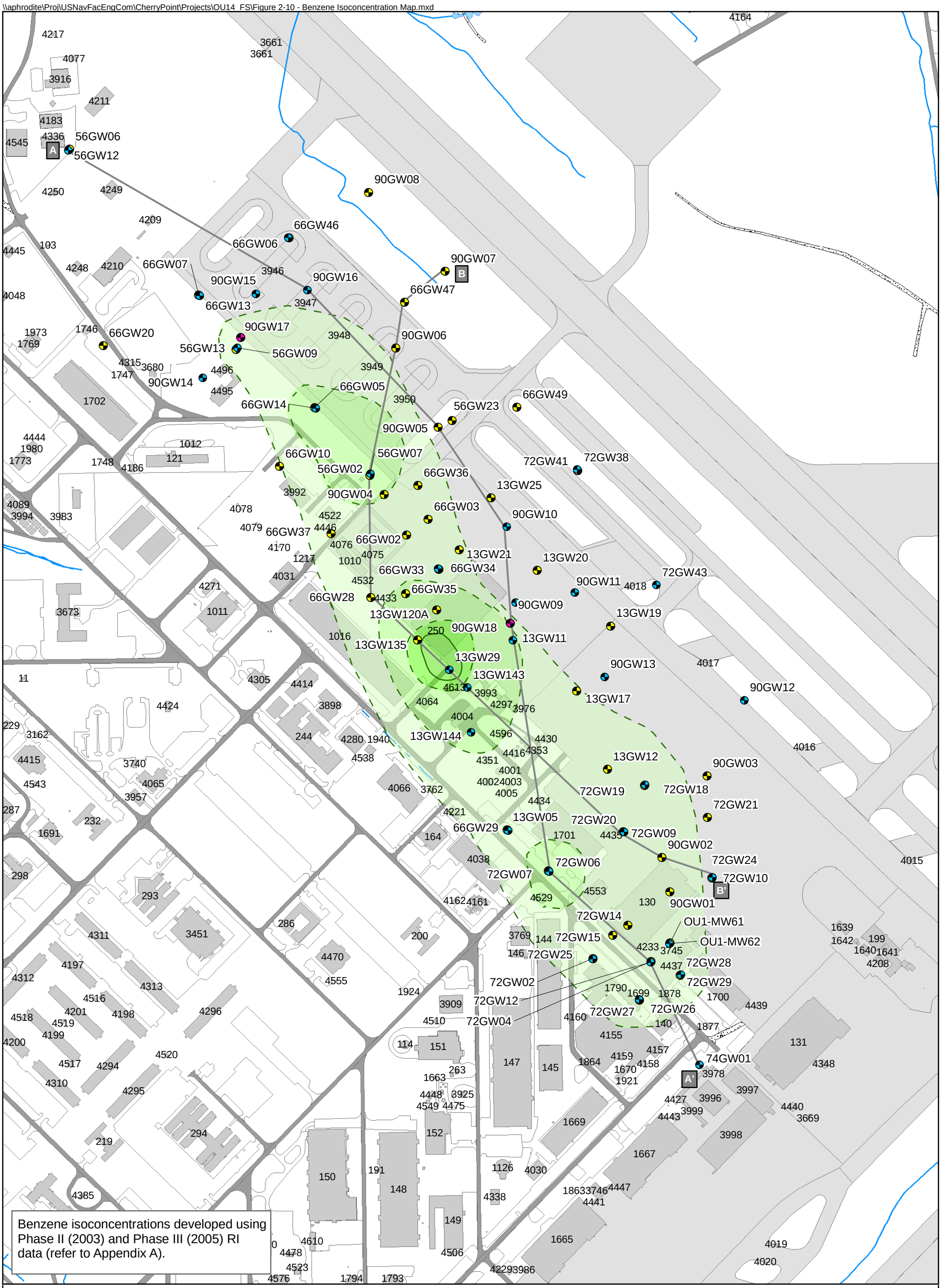
\\aphrodite\Proj\USNavFacEngCom\CherryPoint\Projects\OU14_FS\Figure 2-10 - Benzene Isoconcentration Map.mxd



Legend

- Upper Surficial Aquifer Monitoring Well
- Lower Surficial Aquifer Monitoring Well
- Yorktown Aquifer Monitoring Well
- Transect
- Surface Water
- Isoconcetration Contour (Inferred)
- Isoconcetration Contour

Benzene Isoconcentration Shading

- 1-5 µg/L
- 5-100 µg/L
- 100-200 µg/L
- > 200 µg/L

N W E S

0 250 500 Feet

Figure 2-10
Benzene in Groundwater
Lower Surficial Aquifer
Operable Unit 14, Site 90 Feasibility Study
MCAS Cherry Point
North Carolina

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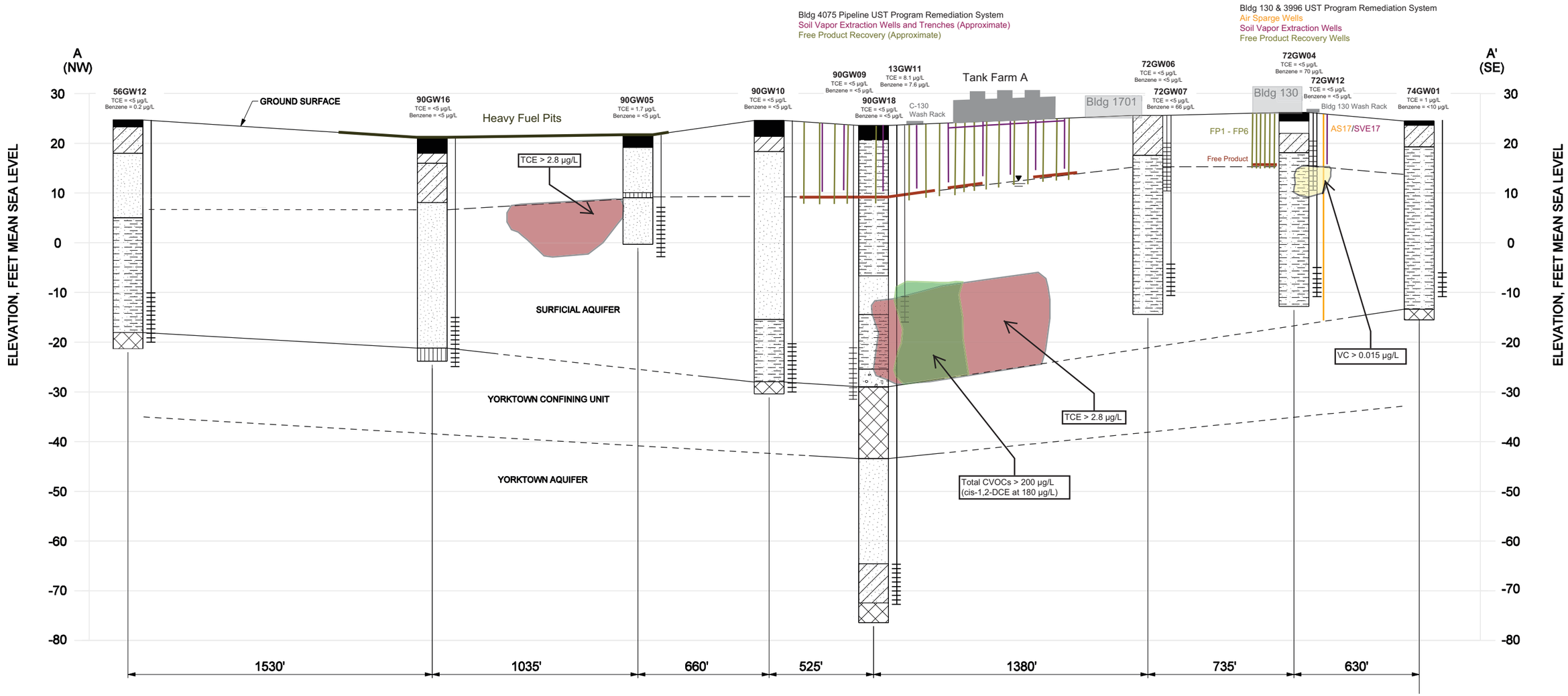

PROFILE

VERTICAL SCALE: 1"=20'
HORIZONTAL SCALE : 1"=500'

Notes:
(1) This cross-section is interpretive and was prepared by interpolation between boring locations. Actual conditions between borings may differ from those shown here.
(2) Isocontours are interpretive and intended to provide an approximate visual snapshot of conditions in the Surficial Aquifer.
(3) UST Remediation System component locations are approximate.
(4) Structure locations and sizes are approximate.

LITHOLOGY/USCS DESCRIPTION

- ASPHALT/CONCRETE/FILL
- SW: WELL GRADED SANDS
- SP: POORLY GRADED SANDS
- SM: SILTY SANDS
- SC: CLAYEY SANDS
- CL: INORGANIC CLAYS (LOW PLASTICITY)
- CH: INORGANIC CLAYS (HIGH PLASTICITY)
- OL: ORGANIC SILTS (LOW PLASTICITY)

LEGEND

- Total CVOCs > 200 µg/L
- TCE > 2.8 µg/L (NC2L)
- VC > 0.015 µg/L (NC2L)
- POL Free Product
- Soil Vapor Extraction Wells and Trenches (Approximate)
- Free Product Recovery (Approximate)
- MONITORING WELL SCREENED INTERVAL
- GROUND WATER TABLE

STRATIGRAPHY

- HYDROSTRATIGRAPHIC CONTACT
- HYDROSTRATIGRAPHIC CONTACT (INFERRED)

Figure 2-11
Interpretive Cross-Section A-A'
Operable Unit 14 Feasibility Study
MCAS Cherry Point
North Carolina

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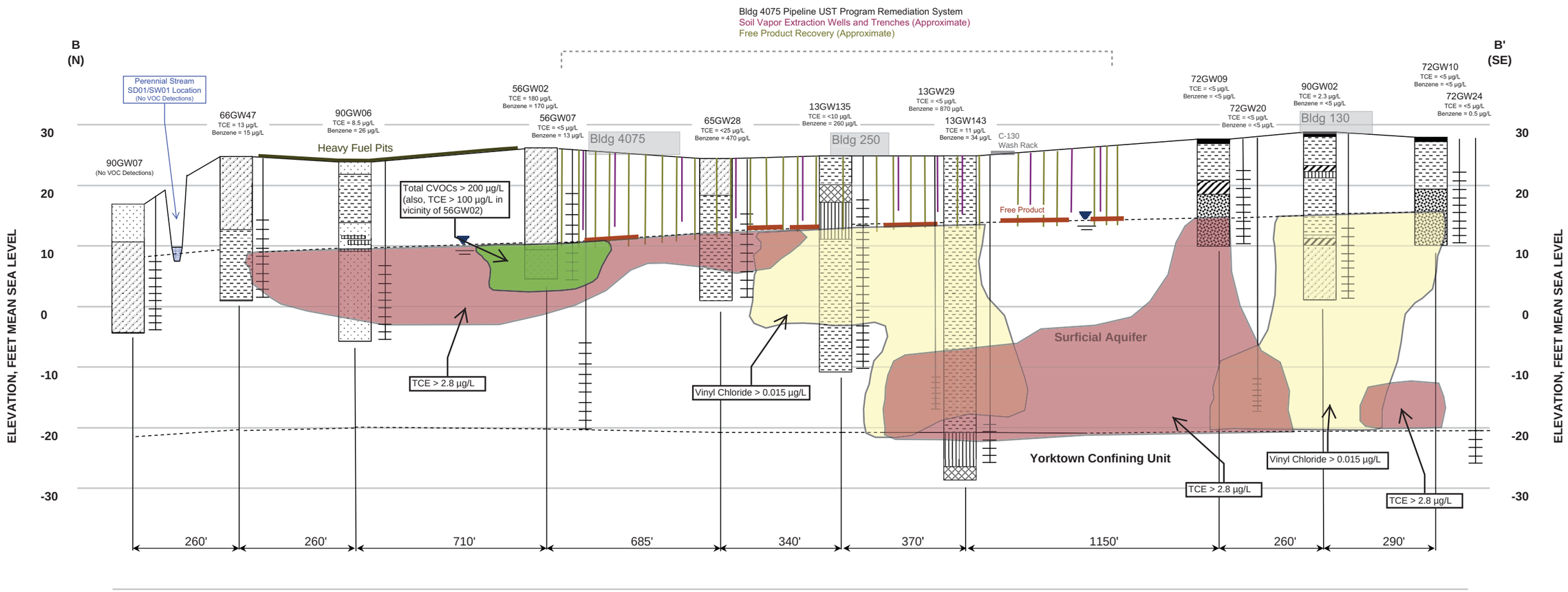

Notes:
(1) This cross-section is interpretive and was prepared by interpolation between boring locations. Actual conditions between borings may differ from those shown here.
(2) Isocontours are interpretive and intended to provide an approximate visual snapshot of conditions in the Surficial Aquifer.
(3) UST Remediation System component locations are approximate.
(4) Structure locations and sizes are approximate.

Lithology/USCS Description

- Asphalt/Concrete/Fill
- SW: Well Graded Sands
- SP: Poorly Graded Sands
- SM: Silty Sands
- SC: Clayey Sands
- CL: Inorganic Clays (Low Plasticity)
- CH: Inorganic Clays (High Plasticity)
- OL: Organic Silts (Low Plasticity)
- Soil Vapor Extraction Wells and Trenches (Approximate)
- Free Product Recovery (Approximate)

Legend

- Monitoring Well Screened Interval
- Groundwater Table
- Hydrostratigraphic Contact
- Hydrostratigraphic Contact (Inferred from other nearby boring logs)
- Total CVOCs > 200 µg/L
- POL Free Product
- TCE > 2.8 µg/L (NC2L)
- VC > 0.015 µg/L (NC2L)

Figure 2-12
Interpretive Cross-Section B-B'
Operable Unit 14 Feasibility Study
MCAS Cherry Point
North Carolina
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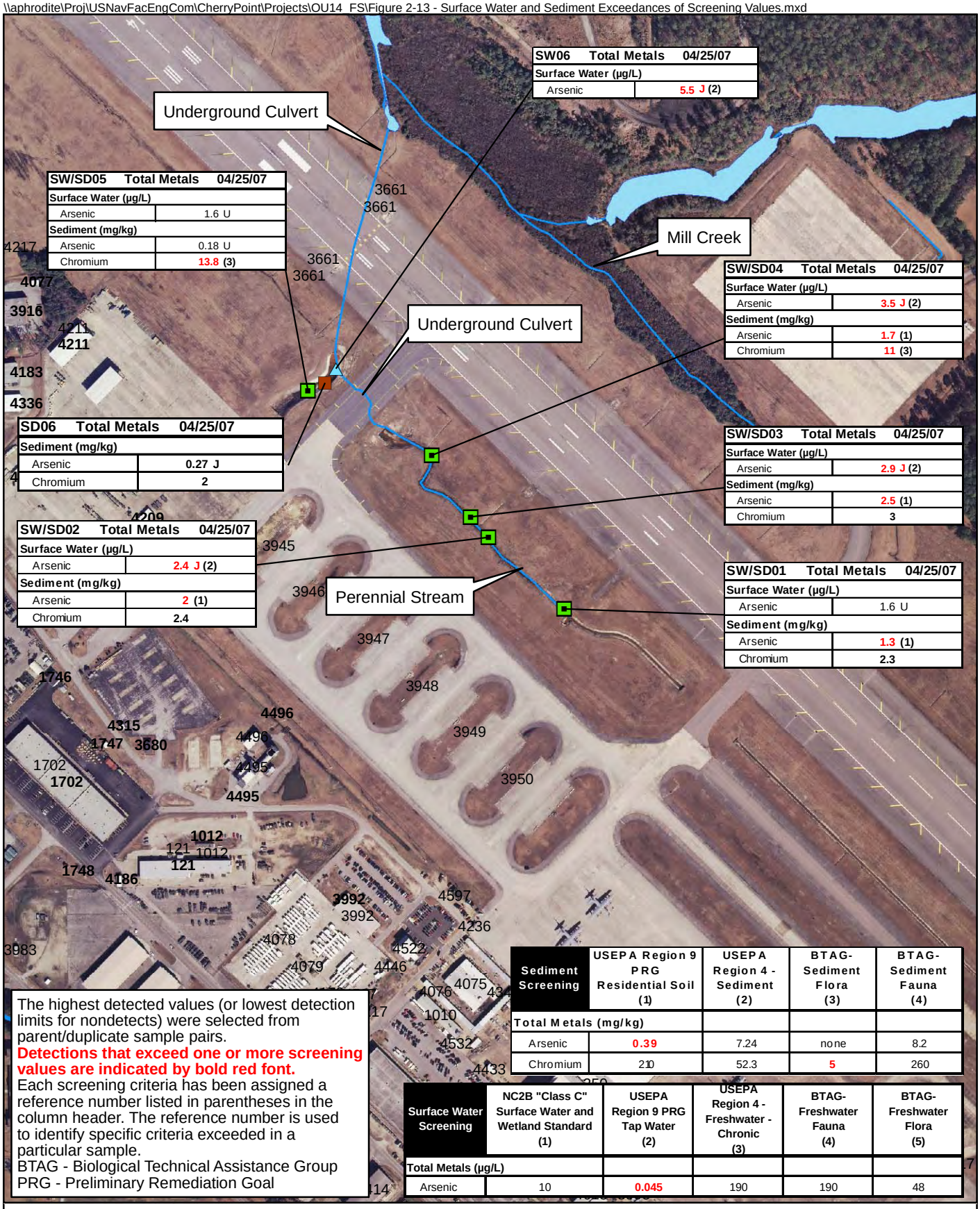

The highest detected values (or lowest detection limits for nondetects) were selected from parent/duplicate sample pairs.
Detections that exceed one or more screening values are indicated by bold red font.
Each screening criteria has been assigned a reference number listed in parentheses in the column header. The reference number is used to identify specific criteria exceeded in a particular sample.
BTAG - Biological Technical Assistance Group
PRG - Preliminary Remediation Goal

Sediment Screening	USEPA Region 9 PRG Residential Soil (1)	USEPA Region 4 - Sediment (2)	BTAG-Sediment Flora (3)	BTAG-Sediment Fauna (4)
Total Metals (mg/kg)				
Arsenic	**0.39**	7.24	none	8.2
Chromium	210	52.3	**5**	260

Surface Water Screening	NC2B "Class C" Surface Water and Wetland Standard (1)	USEPA Region 9 PRG Tap Water (2)	USEPA Region 4 - Freshwater - Chronic (3)	BTAG-Freshwater Fauna (4)	BTAG-Freshwater Flora (5)
Total Metals (µg/L)					
Arsenic	10	**0.045**	190	190	48

Legend
- Sediment Sample
- Surface Water
- Collocated Surface Water/Sediment Sample
- Water Bodies and Streams
- Intermittent Water Body
- Permanent Water Body

N W E S

0 250 500 Feet

Figure 2-13
Surface Water and Sediment Exceedances of RI Screening Values
Operable Unit 14, Site 90 Feasibility Study
MCAS Cherry Point
North Carolina

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SECTION 3

ARARs, RAOs, and PRGs

This section describes the initial steps to develop alternatives for the remediation of groundwater at OU14, including the presentation of ARARs, the development of RAOs, the identification of general response actions (GRAs), and the initial identification and screening of potential technologies.

3.1 NCP Requirements

The NCP requires that the selected remedy meet the following objectives:

- Each remedial action selected shall be protective of human health and the environment [40 CFR 300.430 (f)(1)(ii)(A)].
- Onsite remedial actions that are selected must attain those ARARs that are identified at the time of the ROD signature [40 CFR 300.430(f)(1)(ii)(B)].
- Each remedial action selected shall be cost-effective, provided that it first satisfies the threshold criteria set forth in 40 CFR 300.430 (f)(1)(ii)(A) and (B). A remedy shall be cost-effective if its costs are proportional to its overall effectiveness [40 CFR 300.430 (f)(1)(ii)(D)].
- Each remedial action shall use permanent solutions and alternative treatment technologies or resource-recovery technology to the maximum extent practicable [40 CFR 300.430(f)(1)(ii)(E)].

The statutory scope of CERCLA was amended by SARA to include the following general objectives for remedial action at all CERCLA sites:

- Remedial actions "…shall attain a degree of cleanup of hazardous substances, pollutants, and contaminants released into the environment and of control of further releases at a minimum which assures protection of human health and the environment" [CERCLA Section 121(d)].
- Remedial actions "…in which treatment that permanently and significantly reduces the volume, toxicity, or mobility of the hazardous substances, pollutants, and contaminants is a principal element" [CERCLA Section 121(b)] are preferred. If the treatment or recovery technologies selected are not a permanent solution, an explanation must be published.
- The least-favored remedial actions are those that include "off-site transport and disposal of hazardous substances or contaminated materials without treatment where practicable treatment technologies are available" [Section 121(b)].
- The selected remedy must comply with or attain the level of any "standard, requirement, criteria, or limitation under any Federal environmental law or any

promulgated standard, requirement, criteria, or limitation under a State environmental or facility siting law that is more stringent than any Federal standard, requirement, criteria, or limitation" [Section 121(d)(2)(A)].

3.2 Applicable or Relevant and Appropriate Requirements

As required by Section 121 of CERCLA, remedial actions carried out under Section 104 or secured under Section 106 must attain the levels of standards of control for hazardous substances, pollutants, or contaminants specified by the ARARs of Federal and State environmental laws and State facility-siting laws, unless waivers are obtained. Only promulgated Federal and State laws and regulations can be considered ARARs. If the ARARs do not address a particular situation, remedial actions may be based on the "to be considered" (TBC) criteria or guidelines. ARARs are distinguished by the USEPA as either being applicable to a situation or relevant and appropriate to it. These distinctions are critical to understanding the constraints imposed on RAs by environmental regulations other than CERCLA. The definitions of ARARs and TBCs below are from the NCP (40CFR 300.5) and USEPA (1991).

- **Applicable requirements** are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site.
- **Relevant and appropriate requirements** are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that, while not "applicable," address problems or situations sufficiently similar (relevant) to those encountered at a CERCLA site, that their use is well-suited (appropriate) to the particular site.
- **TBC information** are non-promulgated criteria, advisories, guidance, and proposed standards that have been issued by the Federal or State government that are not legally binding and do not have the status of potential ARARs. However, the TBC information may be useful for developing an interim remedial action or for determining the necessary level of cleanup for the protection of human health and/or the environment. Examples of TBC information include EPA Drinking Water Health Advisories, Reference Doses, and Cancer Slope Factors.

Another factor in determining which response or remedial requirements must be met is whether the requirement is substantive or administrative. CERCLA response actions must meet substantive requirements but not administrative requirements. Substantive requirements are those dealing directly with actions or with conditions in the environment. Administrative requirements implement the substantive requirements by prescribing procedures such as fees, permitting, and inspection that make substantive requirements effective. This distinction applies to onsite actions only; offsite response actions are subject to all applicable standards and regulations, including administrative requirements such as permits.

3.2.1 Determination of ARARs and TBCs

Federal and NC ARARs are summarized in Appendix B. The tables summarize the ARARs by classification (and TBC criteria as appropriate for each classification): chemical-specific, location-specific, and action-specific (see below).

The remedial action alternatives developed in this FS report were analyzed for compliance with Federal and NC ARARs. The analyses involved identifying potential requirements for each of the alternatives, evaluating their applicability or relevance, and determining if the alternative(s) can achieve the ARARs. Results of that analysis are presented in Section 4. Any remedial action at the site must meet standards as defined by the ARARs of USEPA and NC. If the ARARs do not address a particular situation, remedial actions may be based on the TBC criteria or guidelines.

Chemical-Specific ARARs

Chemical-specific ARARs set health-based concentration limits or discharge limits in various environmental media for specific hazardous substances, pollutants, or contaminants. Examples of chemical-specific ARARs for OU14 are (1) the Federal Safe Drinking Water Act MCLs and MCL Goals that are enforceable standards for drinking water sources; (2) the State of North Carolina's NC2L Groundwater Standards that are enforceable for drinking water sources and as an antidegradation / beneficial use standard; and (3) the State of North Carolina's NC2B Surface Water Standards. An example of a chemical-specific TBC for OU14 is the USEPA (2008b) human health risk-based Regional Screening Levels for Chemical Contaminants at Superfund Sites. Chemical-specific ARARs and TBCs for OU14 are presented in Table B-1 in Appendix B.

The primary chemical-specific ARAR for establishing groundwater cleanup levels at OU14 is the NC2L Groundwater Standards. The NC2Ls are generally equal to or are more conservative than Federal MCLs. In the case of OU14, the NC2Ls for the FS COCs (Table 3-1b) are all lower or equal to the MCLs, or there is no MCL value.

Location-Specific ARARs

Location-specific ARARs are design requirements or activity restrictions that are based on the geographical position of a site. An example is RCRA location requirements that set USEPA policy for carrying out provisions of Executive Order 11988 (Flood Plain Management) and Executive Order 11990 (Protection of Wetlands). Location-specific ARARs for OU14 are presented in Table B-2. The primary location-specific ARAR applicable to any of OU14's remedial alternatives is the Land-Use Restrictions / Controls for Waste Sites (NCGS 130A-310.3 & 310.8).

Action-Specific ARARs

Action-specific ARARs set performance, design, or other standards for particular activities in managing hazardous substances or pollutants. For example, the design requirements for landfilling hazardous waste, established in RCRA 40 CFR Section 264.301, are action-specific. RCRA contains the greatest number of action-specific ARARs because it regulates hazardous waste management. Action-specific ARARs for OU14 are presented in Table B-3. Depending on the selected remedy, injection wells may be employed, which would need to comply with Well Construction and Injection Standards (15A NCAC 2C .0100 & .0200).

3.3 Remedial Action Objectives

The RAOs are statements that define the extent to which sites require cleanup to protect human health and the environment. The RAOs reflect the COCs, exposure routes and receptors, and acceptable contaminant concentrations (or range of acceptable contaminant concentrations) for each medium of concern at OU14. The RAOs for OU14 are as follows:

3.3.1 Surficial Aquifer Groundwater

- Prevent human exposure to Surficial Aquifer groundwater containing COCs above cleanup levels.
- Reduce exceedances of COCs to cleanup levels.
- Achieve suitability of OU14 groundwater for unlimited use with a reasonable approach and within a reasonable timeframe.
- Prevent migration or discharge of COCs in the Surficial Aquifer groundwater to sediment and surface water at levels that would cause unacceptable risks to human or ecological receptors.

3.3.2 Indoor Air Vapor

- Prevent unacceptable risks to human receptors from exposure to vapors resulting from subsurface contaminants.

3.4 Performance Criteria

Performance criteria are established in this section for purposes of evaluating remedial alternatives and for use in the conceptual design and cost estimates. Performance criteria provide a basis for delineating the extent and volume of contaminated media that require remediation and provide the design performance of the remedial alternatives. The performance criteria described here represent the levels of performance necessary to meet the RAOs. They also provide benchmarks for achieving compliance with ARARs (or when applicable, complying with ARAR waiver criteria).

A monitoring program capable of demonstrating conformance with the performance criteria (below; to be finalized in the ROD) would be an element of each remedial alternative.

3.4.1 Surficial Aquifer Groundwater

The performance criteria for Surficial Aquifer groundwater will be the PRGs, which are established as follows. Table 3-1a shows the FS COCs in Surficial Aquifer groundwater categorized by NC2L exceedance and/or associated receptor. These COCs were determined in the RI Report (CH2M HILL, 2008). As agreed by the Partnering Team, the PRG for each COC will be determined by selecting the most conservative of the site-specific risk-based RGO (TCR of 10^{-5} and HI of 1; calculated in the OU14 RI Report), NC2L, and/or MCL values, but no lower than the most conservative (lowest) chemical-specific ARAR (typically the NC2L).

Table 3-1b summarizes the COCs and PRGs for Surficial Aquifer groundwater. There is no NC2L or MCL for bromomethane; therefore, the risk-based RGO was selected as the PRG. The PRGs will be finalized as cleanup levels in the ROD.

3.4.2 Surface Water and Sediment

The Baseline HHRA and screening level ERA for OU14 concluded that there were no unacceptable risks from exposure to surface water or sediment in the unnamed stream. Additionally, there were no COC exceedances of the chemical-specific ARARs or TBCs for these media (see below) during the RI. Therefore, no remedial alternatives directly addressing surface water and sediment were evaluated in this FS. The remedial alternatives for groundwater will address any potential surface water and sediment issues related to the COCs. The cleanup levels for groundwater are more stringent than NC regulatory standards for surface water.

Surface Water

The human health performance criteria for surface water are the NC2B Class C Surface Water Standards (more stringent of the Freshwater Aquatic Life value and Human Health value) and the Federal Ambient Water Quality Criteria (AWQC) for Human Health Freshwater Ingestion of Organisms and Water (Clean Water Act, Section 304[a]; USEPA, 2006). This is consistent with the values used in the Baseline HHRA (CH2M HILL, 2008).

The ecological surface water performance criteria are the NC2B [Ecological] Surface Water Standards (more stringent of Freshwater Aquatic Life value and Trout Waters value). This is consistent with the values used in the screening level ERA (CH2M HILL, 2008).

Sediment

There are no chemical-specific ARARs for sediment concentrations. However, the performance criteria for sediment could be based on the following TBCs. For human health, the performance criteria could be the residential soil values from the USEPA (2008b) human health risk-based Regional Screening Levels divided by 10, which is consistent with values used in the Baseline HHRA (CH2M HILL, 2008) .

The ecological performance criteria for sediment could be the freshwater sediment ESVs from USEPA Region 4 (2001b), or the USEPA Region 3 (2005) ESVs when no Region 4 ESVs are available (consistent with the values used in the screening level ERA [CH2M HILL, 2008]).

3.4.3 Indoor Air Vapor

Indoor air vapor is not addressed by this FS. The vapor intrusion evaluation during the RI determined no immediate risk to current workers from indoor air vapor issues associated with CERCLA contaminants beneath currently existing buildings. Remedial alternatives for groundwater will indirectly address vapor issues, as the potential vapors emanate from the COCs and other VOCs in groundwater at the site. LUCs to address potential indoor air issues are expected to be a component of the selected alternative(s).

3.5 Groundwater PRG Attainment Areas

The nature and extent of contamination at OU14 was summarized in Section 2.2.4. This section narrows the description of contamination to those media and areas that will be addressed by the remedial alternatives to achieve RAOs and comply with ARARs to the extent possible.

The Attainment Area (AA) is defined as the area over which RAOs, and therefore, the PRGs, are to be met for groundwater. The AA may not necessarily become the area of remediation depending on the effectiveness, implementability, cost, and net benefit for a particular alternative. The AA also is not necessarily the areal extent to be restricted by LUCs (e.g., aquifer use restrictions) until cleanup levels are met.

Two Surficial Aquifer groundwater AAs (AA1 and AA2 shown on Figure 3-1) were determined based on the former source area locations and spatial grouping of PRG exceedances for each of the FS COCs. These AAs apply to the entire saturated thickness of the Surficial Aquifer (i.e., there is no differentiation between the Upper and Lower Surficial Aquifer with respect to the AAs).

Groundwater Travel Time and Distance. Considering the estimated groundwater velocities (31 and 26 ft/yr in the Upper and Lower Surficial Aquifer, respectively) reported in the RI Report (CH2M HILL, 2008), the estimated groundwater travel time through AA1 from the Former Refueling Station to the unnamed stream (approximately 1,200 ft) is 40 years in the Upper and 50 years in the Lower Surficial Aquifer. The estimated groundwater travel time through AA2 from the Building 130 Wash Rack to the unnamed stream (approximately 4,300 ft along predominant groundwater flow path) is 140 years in the Upper and 170 years in the Lower Surficial Aquifer.

3.5.1 Attainment Area No. 1

AA1 measures approximately 1.8 acres and is associated with TCE contamination in the Lower Surficial Aquifer at 30 to 40 ft bgs near the Former Refueling Station—based on the 2005 TCE concentration in well 56GW09 (15 µg/L, above the PRG of 2.8 µg/L) (Figure 3-1). The total volume of Surficial Aquifer groundwater in AA1, assuming a porosity of 0.25 and a 25-ft thick saturated thickness, is 11 acre-ft (3.7 million gallons). The volume of TCE-contaminated groundwater at 25 to 40 ft bgs within the estimated TCE-2.8-µg/L isoconcentration contour (1.2-acres based on TCE at 15 µg/L in well 56GW09) is 4.5 acre-ft (1.5 million gallons).

3.5.2 Attainment Area No. 2

AA2 includes approximately 55 acres associated with multiple former source zones and/or hot spots identified during the RI, consisting mostly of groundwater contaminated with DCAs, DCEs, TCE, and VC in both the Upper and Lower Surficial Aquifer (Figures 2-6 through 2-8, 2-11, and 2-12). AA2 encompasses all the discernable plumes from various former sources (and all wells with COC concentrations above PRGs), extending over ¾ of a mile from the Building 130 area. The total volume of Surficial Aquifer groundwater in AA2, assuming a porosity of 0.25 and a 30-ft thick saturated thickness, is 412 acre-ft (134 million gallons).

The CVOCs from the various sources have commingled with each other and with site-wide POL compounds (e.g., benzene). While specific contaminant plumes and PRG exceedances appear isolated to the Upper versus the Lower Surficial Aquifer at some locations, each stratified plume overlaps into a contiguous plume of CVOCs and benzene/POL across AA2 (Section 2.2.4; Figures 2-8 through 2-12).

The most definitive hotspot within AA2 originates from the Building 4075 area and extends over 900 ft downgradient. The contamination at this location consists of TCE (and other CVOCs) in the Upper Surficial Aquifer at approximately 15 to 30 ft bgs (Figure 2-12). Considering the 14-acre size of the estimated TCE-2.8-µg/L isoconcentration contour surrounding this hotspot, the volume of TCE-contaminated groundwater is 52 acre-ft (17 million gallons). Within the TCE-100-µg/L isoconcentration contour (0.5 acre area based on the concentration of TCE at 180 µg/L in well 56GW02), the volume of groundwater with TCE concentrations above 100 µg/L at 15 to 25 ft bgs (Figure 2-12) totals 1.3 acre-ft (420,000 gallons).

Other notable hot spots, mostly commingled, within AA2 include the following:

- TCE and VC originating from the Building 130 Wash Rack and extending just past Building 130, mostly in the Upper Surficial Aquifer.
- VC in the Upper and Lower Surficial Aquifer around Building 250 and the concentrated area of mixed CVOCs in the Lower Surficial Aquifer located southeast of Building 250 and north of the C-130 Wash Rack.
- Elongated area of TCE and mixed CVOCs beginning at the vicinity of well pair 72GW18/19 (north of Building 130) and extending to Building 250, mostly in the Lower Surficial Aquifer.

Table 3-1a
Selection of Surficial Aquifer Groundwater PRGs
Operable Unit 14, Site 90 Feasibility Study
MCAS Cherry Point, North Carolina

OU14 Surficial Aquifer Groundwater COC	Exposure Point Concentration from Baseline HHRA (µg/L)	RGO = 1 (µg/L)	NC2L Criteria (µg/L)	Federal MCL (µg/L)	Selected Groundwater PRG (µg/L)
COC forwarded from the RI to the FS due to NC2L exceedance					
1,1-Dichloroethane	170	N/A	70	none	70
Chloromethane	3	N/A	2.6	none	2.6
Methylene Chloride	7	N/A	4.6	5	4.6
COC forwarded from the RI to the FS based on results of the Baseline Human Health Risk Assessment					
Residential Adult					
None	--	--	--	--	--
Residential Child					
1,2-Dichloroethane	3.8	20.5	0.38	5	0.38
Vinyl chloride	5.8	23.5	0.015	2	0.015
cis-1,2-Dichloroethene	19.5	78.2	70	70	70
Trichloroethene	14.9	46.9	2.8	5	2.8
Lifetime Adult/Child Resident					
1,2-Dichloroethane	3.8	3.7	0.38	5	0.38
Tetrachloroethene	1	0.62	0.7	5	0.7
Trichloroethene	14.9	30.4	2.8	5	2.8
Vinyl chloride	5.8	0.22	0.015	2	0.015
Construction Worker Adult					
1,2-Dichloroethane	3.8	8.3	0.38	5	0.38
Bromomethane	4.4	21.1	none	none	21.1

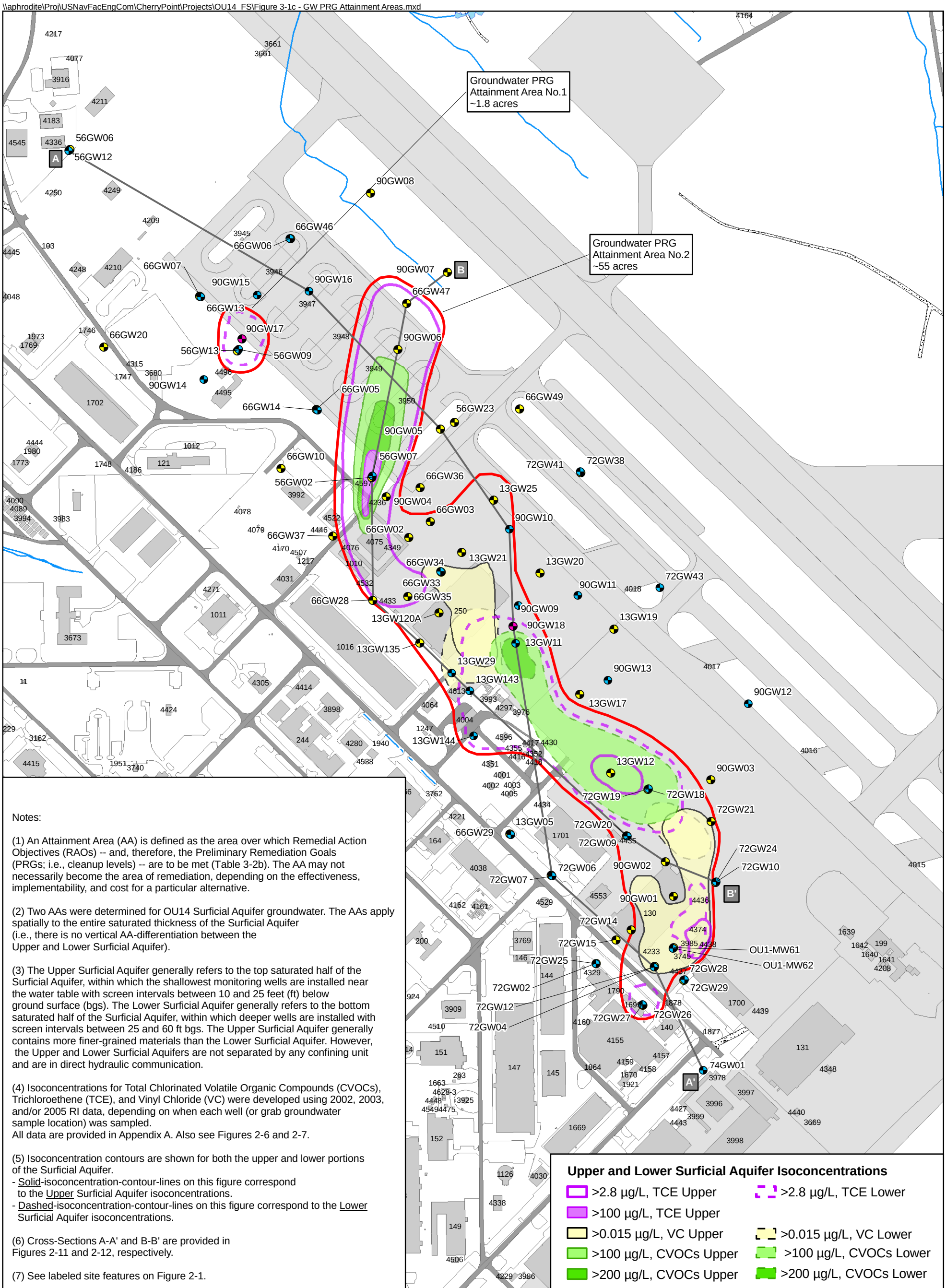
Notes
The Baseline Human Health Risk Assessment (HHRA) is in the Final OU14 Remedial Investigation Report (CH2M HILL, 2008).
Remedial Goal Options (RGOs) were calculated in the Baseline HHRA (RI Report Table 7-6). RGO = 1 used for PRG selection.
RGO = 1 selected for PRG determination (equivalent to 10^{-5} for carcinogens or Hazard Index of 1 for noncarcinogens).
For carcinogens: RGO = (Exposure Point Concentration x Target Risk Level)/ Total Cancer Risk
For noncarcinogens: RGO = (Exposure Point Concentration x Target Hazard Level)/ Total Hazard Quotient
NC2L – North Groundwater Standards as defined in North Carolina Administrative Code Title 15A, Subchapter 2L, "Class GA" (May 2005)
N/A - Not Applicable
PRG is selected based on most conservative criteria not to be below the NC2L.
RI - Remedial Investigation
FS - Feasibility Study
COC - Chemical of Concern under CERCLA
MCL - Maximum Contaminant Level
There is no NC2L for bromomethane

Table 3-1b
Summary of OU14 Surficial Aquifer Groundwater COCs and PRGs
Operable Unit 14, Site 90 Feasibility Study
MCAS Cherry Point, North Carolina

OU14 Groundwater COC	OU14 Groundwater PRG (µg/L)	Basis
1,1-Dichloroethane (1,1-DCA)	**70**	NC2L
1,2-Dichloroethane (1,2-DCA)	**0.38**	NC2L
Bromomethane	**21.1**	Calculated Site-Specific RGO
Chloromethane	**2.6**	NC2L
Cis-1,2-dichloroethene (cis-1,2-DCE)	**70**	NC2L
Methylene Chloride	**4.6**	NC2L
Tetrachloroethene (PCE)	**0.7**	NC2L
Trichloroethene (TCE)	**2.8**	NC2L
Vinyl chloride (VC)	**0.015**	NC2L

Notes
NC2L – North Groundwater Standards as defined in North Carolina Administrative Code Title 15A, Subchapter 2L, "Class GA" (May 2005)
µg/L – micrograms per liter
COC - Chemical of Concern under CERLCA
There is no NC2L for bromomethane. Therefore, the PRG is the Remedial Goal Option (RGO) for bromomethane. The RGO was calculated in the Baseline HHRA (RI Report Table 7-6). RGO = 1 used for PRG selection.

\\aphrodite\Proj\USNavFacEngCom\CherryPoint\Projects\OU14_FS\Figure 3-1c - GW PRG Attainment Areas.mxd



Notes:

(1) An Attainment Area (AA) is defined as the area over which Remedial Action Objectives (RAOs) -- and, therefore, the Preliminary Remediation Goals (PRGs; i.e., cleanup levels) -- are to be met (Table 3-2b). The AA may not necessarily become the area of remediation, depending on the effectiveness, implementability, and cost for a particular alternative.

(2) Two AAs were determined for OU14 Surficial Aquifer groundwater. The AAs apply spatially to the entire saturated thickness of the Surficial Aquifer (i.e., there is no vertical AA-differentiation between the Upper and Lower Surficial Aquifer).

(3) The Upper Surficial Aquifer generally refers to the top saturated half of the Surficial Aquifer, within which the shallowest monitoring wells are installed near the water table with screen intervals between 10 and 25 feet (ft) below ground surface (bgs). The Lower Surficial Aquifer generally refers to the bottom saturated half of the Surficial Aquifer, within which deeper wells are installed with screen intervals between 25 and 60 ft bgs. The Upper Surficial Aquifer generally contains more finer-grained materials than the Lower Surficial Aquifer. However, the Upper and Lower Surficial Aquifers are not separated by any confining unit and are in direct hydraulic communication.

(4) Isoconcentrations for Total Chlorinated Volatile Organic Compounds (CVOCs), Trichloroethene (TCE), and Vinyl Chloride (VC) were developed using 2002, 2003, and/or 2005 RI data, depending on when each well (or grab groundwater sample location) was sampled.
All data are provided in Appendix A. Also see Figures 2-6 and 2-7.

(5) Isoconcentration contours are shown for both the upper and lower portions of the Surficial Aquifer.
- Solid-isoconcentration-contour-lines on this figure correspond to the Upper Surficial Aquifer isoconcentrations.
- Dashed-isoconcentration-contour-lines on this figure correspond to the Lower Surficial Aquifer isoconcentrations.

(6) Cross-Sections A-A' and B-B' are provided in Figures 2-11 and 2-12, respectively.

(7) See labeled site features on Figure 2-1.

Upper and Lower Surficial Aquifer Isoconcentrations

- >2.8 µg/L, TCE Upper
- >2.8 µg/L, TCE Lower
- >100 µg/L, TCE Upper
- >0.015 µg/L, VC Upper
- >0.015 µg/L, VC Lower
- >100 µg/L, CVOCs Upper
- >100 µg/L, CVOCs Lower
- >200 µg/L, CVOCs Upper
- >200 µg/L, CVOCs Lower

Legend

- Lower Surficial Aquifer Monitoring Well
- Yorktown Aquifer Monitoring Well
- Upper Surficial Aquifer Monitoring Well
- Transect for Cross-Section
- Groundwater PRG Attainment Area
- Surface Water

N W E S

0 250 500 Feet

Figure 3-1
Groundwater PRG Attainment Areas
Surficial Aquifer Groundwater
Operable Unit 14, Site 90 Feasibility Study
MCAS Cherry Point
North Carolina

CH2MHILL

SECTION 4

Identification and Screening of Remedial Technologies and Alternatives

4.1 General Response Actions

The GRAs describe the broad range of actions that will satisfy the RAOs at the site. The GRAs may include no action, institutional controls, monitoring, containment, removal, treatment, disposal or any combination of these. Consideration of the No Action GRA is required by CERCLA.

With the exception of the No Action alternative, each GRA can be achieved through the implementation of site-specific remedial technologies. In this context, the following definitions apply:

- Remedial technologies are defined as the general categories of remedies under a GRA. For example, in situ chemical treatment is one of the remedial technologies under the GRA of treatment.
- Process options are specific categories of remedies within each remedial technology. The process options are used to implement each remedial technology. For example, the chemical treatment remedial technology could be implemented using one of several types of treatment options (e.g., in situ chemical oxidation [ISCO] or chemical reduction [ISCR]).

Table 4-1 lists the GRAs for groundwater contamination and their effectiveness for meeting the RAOs. Tables 4-2a and 4-2b identify potentially applicable technologies and process options for addressing COC-contaminated groundwater at OU14. The representative process options were selected to simplify the development and evaluation of alternatives in accordance with USEPA (1988). The technologies and process options retained following a primary (Table 4-2a) and secondary (Table 4-2b) screening for effectiveness, implementability, and cost are combined into remedial alternatives in Section 5, and are evaluated under an expanded set of evaluation criteria in Section 6.

Some technologies were excluded upfront from further consideration because of economics, impracticality, site conditions, or COC characteristics. The specific process option used to implement a remedial action may not be selected until the remedial design (RD) phase has been completed. Selection of a representative process option does not preclude the application of other process options that are potentially applicable for the site.

4.2 Sustainability

Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, requires Federal agencies to implement sustainable practices. Sustainability is a *greening* process focused on energy conservation, reduction of green house gases, waste minimization, and re-use and recycling of materials. However, a more comprehensive view

of sustainable remediation considers stakeholders input and concerns, optimizing the use of land to benefit society, and focusing on developing remedies that provide the best net sustainability benefit. These considerations are not NCP requirements for remedial alternatives, but may be considered during the technology and alternative selection process.

4.2.1 Green Remediation

Green remediation results in effective cleanups minimizing the environmental and energy footprints of site remediation and revitalization. Sustainable practices emphasize the need to more closely evaluate core elements of a cleanup project, compare the site-specific value of conservation benefits gained by different strategies of green remediation, and weigh the environmental trade-offs of potential strategies. Green remediation addresses the following six core elements (USEPA, 2008a):

- Energy requirements of the treatment system
- Air emissions
- Water requirements and impacts on water resources
- Land and ecosystem impacts
- Material consumption and waste generation
- Long-term stewardship actions

4.2.2 Beyond Green Remediation

In addition to the core elements addressed by green remediation, and expanding on long-term stewardship, the following can also be considered:

- Integrating Stakeholders (e.g., regulators, nongovernmental organizations, neighbors) into the decision-making process, especially in considering the impact of the remedy on the local community
- Land Revitalization and Re-Use
- Life Cycle Analysis (which includes elements of Net Environmental Benefit Analysis)

Extensive net impact analyses (e.g., a Net Environmental Benefit Analysis [NEBA][6] or carbon footprint calculations) can be conducted to aid in the selection of a remedy that provides the best net environmental and sustainable benefit. However, the energy consumption and carbon footprint of the remedial implementation (obtaining raw materials and manufacturing, transportation of materials and travel, implementation emissions, etc.) were not quantified in this FS, and a NEBA was not conducted for OU14.

[6] http://www.esd.ornl.gov/programs/ecorisk/net_environmental.html (Oak Ridge National Laboratory [ORNL], 2008).

4.3 Screening of Technologies and Process Options for Groundwater

Results of the initial OU14 technology screening process are presented in Tables 4-2a and 4-2b. A brief discussion of two alternatives that are not considered technologies, No Action and LUCs, is provided below.

4.3.1 No Action

No Action means no remedial actions or process options are implemented. No attempt is made to satisfy the RAOs. The No Action alternative is evaluated to determine the risks to human health and the environment if no additional actions were taken, and is the baseline against which other options/alternatives are compared. Therefore, No Action is retained as a possible response action. The retention of the No Action alternative satisfies CERCLA requirements, but will not mitigate risk from the contaminated groundwater.

4.3.2 Land-Use Controls

LUCs are used to restrict access to or the use of land (or underlying aquifer resources). LUCs relevant to OU14 would limit human exposure to contaminated groundwater (and potential indoor air vapor [see Sections 2.2.6 and 3.4.3]). In addition to being a stand-alone remedy, LUCs are applicable for any remedy where contaminated groundwater is left in place or during the treatment phase of the selected remedy until cleanup levels are met. LUCs may be layered for greater effectiveness and may be implemented in conjunction with other response actions/options. Implementation of these process options alone would not necessarily attain the RAOs.

Administrative control options include groundwater use restrictions and other restrictions on land use. Groundwater use restrictions would prohibit groundwater use in areas where contaminant concentrations exceed cleanup levels. The Air Station could internally restrict and control onbase groundwater use, and the authority for regulating and enforcing groundwater use restrictions would fall within the Air Station's command structure. No offbase restrictions are needed because only onsite groundwater has been impacted at OU14. Surficial Aquifer groundwater is not currently used as a potable or nonpotable water supply at MCAS Cherry Point. Regarding potential future vapor intrusion issues, any restrictions or special procedures related to building construction would be detailed in the RD.

The effectiveness of LUCs to limit exposure to COCs in groundwater and indoor air vapor depends on successful implementation and long-term program maintenance. LUCs are retained as a stand-alone remedy and for use with other remedial alternatives as necessary to maintain protectiveness and effectiveness of the remedial alternative. LUCs are developed further in Section 5.2.2. In addition, potential future vapor issues will be addressed indirectly by the selected groundwater alternative.

4.3.3 Summary of Retained Technologies

The remedial technologies were evaluated using a screening process for applicability to OU14. Table 4-3 presents a summary of the retained remedial technology type and process

options after the primary and secondary screening processes. These will be developed into alternatives and discussed in Section 5.

Table 4-1
General Response Actions
Operable Unit 14, Site 90 Feasibility Study
MCAS Cherry Point, North Carolina

General Response Action (GRA)	Effect Associated with Remedial Actions Objectives (RAOs)
No Action	None. Serves as a baseline to compare other response actions.
Institutional Controls	Prevents human exposure to groundwater by placing restrictions on aquifer use and activities that may result in exposure.
Monitoring	Performed in conjunction with other alternatives to determine if RAOs are being met or if/when cleanup goals are met. *Monitored Natural Attenuation (MNA)* is a technology option for the *Monitoring* GRA and the [In Situ] *Treatment* GRA. *MNA* alone is an intrinsic process to reduce contaminant concentrations (and, thus, toxicity and volume) without performing any other measures (Table 4-2) .
Containment	Minimizes or prevents the migration of contaminants in the groundwater to receptors.
Removal	Removes contaminants from the saturated zone by physical extraction of groundwater and/or removal of impacted saturated soil.
Treatment (In situ or Ex situ)	Reduces the mobility, toxicity, or volume of contaminated groundwater.

Table 4-2a
<u>Primary</u> Screening of Groundwater Remediation Technologies and Process Options
Feasibility Study
Operable Unit 14, Site 90
MCAS Cherry Point, North Carolina

General Response Action	Remedial Technology	Process Options	Description	Target Contaminant Class						Comments	Advantages	Disadvantages	Primary Screening	
				Hydrocarbons										
				VOCs	Non-VOCs	SVOCs	CVOCs**, Chlorinated Pesticides	Nutrients	Metals and Radio-nuclides				Retain	Reject
No Action	None	Not applicable	No action provided. This process option is retained to provide the basis for comparing active process options and technologies.	✔✔	✔✔	✔✔	✔✔	✔✔	✔✔	This process option is retained to provide the basis for comparing active process options and technologies.	None.	Does not address RAOs.	X	
Institutional Controls	Administrative restrictions	Land-Use Controls (LUCs) / Deed Restrictions and notices	LUCs issued for property within potentially contaminated areas to restrict property use and well installation.	✔✔	✔✔	✔✔	✔✔	✔✔	✔✔	Aids in preventing human activities that may increase impacts or exposure to contaminants (i.e., helps to prevent human exposure to COCs in groundwater and indoor air vapor issues resulting from COCs in groundwater).	Can be combined with other technologies to enhance performance. Can be used for short-term or long-term remedies, and can be easily removed. Can be cost-effective. The Navy uses a Web-based management tool, *LUC Tracker* , as part of the Naval Installation Restoration Information System (NIRIS).	Cannot meet RAOs by itself. Can limit short-term and possibly long-term site use. Requires legal documentation and administration of controls.	X	
	Access restrictions	Fences	Security fences installed around potentially contaminated areas to limit access.	✔✔	✔✔	✔✔	✔✔	✔✔	✔✔	Prevents public from entering site, and provides site security.	Transferable and binding on subsequent purchasers of the property. Effective restrictions and controls associated with the property/land.	Cannot meet RAOs by itself. May limit property transactions. Security at active military installation and particularly the airfield already established.		X
	Alternative Drinking Water Source	Cisterns or Tanks	Drinking water is dispensed to users from a central point.	✔✔	✔✔	✔✔	✔✔	✔✔	✔✔	Not applicable, no drinking water wells affected	Drinking water source not impacted by COCs.	Does not address RAOs. Space required to store tank. Cost associated with maintenance and distribution.		X
		Bottled Water	Drinking water is obtained from a commercial vendor.	✔✔	✔✔	✔✔	✔✔	✔✔	✔✔	Not applicable, no drinking water wells affected	Drinking water source not impacted by COCs.	Does not address RAOs. Cost of purchasing water.		X
		Deeper or Upgradient Wells	Wells are installed deep or upgradient if these areas are isolated from contamination.	✔✔	✔✔	✔✔	✔✔	✔✔	✔✔	Not applicable, no drinking water wells affected	Drinking water source not impacted by COCs.	Does not address RAOs. Installation and permitting of new wells. Subsequent pipelines required for distribution.		X
		Municipal Water Supply	Additional water sources are established.	✔✔	✔✔	✔✔	✔✔	✔✔	✔✔	Not applicable, no drinking water wells affected	Drinking water source not impacted by COCs.	Does not address RAOs. Already in place.		X
Monitoring	Sampling	Performance and Compliance Monitoring	Sample media containing COCs and/or media at points of compliance.	✔✔	✔✔	✔✔	✔✔	✔✔	✔✔	Determine if remedy is working as intended (are COC concentrations decreasing and/or are performance indicators meeting objectives); efficiency of remedy; monitor COC concentrations in media at points of compliance.	Does not require infrastructure installation except for any new monitoring wells if needed. It does not rely on delivery of amendments to subsurface. There is no O&M, other than monitoring well maintenance and no waste stream other than purge water from sampling events.	None. Not intended to be a remedy that meets RAOs. Monitoring will be part of any selected remedy.	X	
	Monitored Natural Attenuation (MNA)	Intrinsic process and Performance Monitoring	Natural attenuation (all mechanisms including biodegradation, advection-dispersion, dilution, etc.) coupled with regular monitoring for the COCs as well as for other indicators of biodegradation.	✔✔	✔✔	✔✔	✔✔	✔✔	✔✔	Provides same information as *Monitoring* . Physical, biological and geochemical conditions must be suitable for attenuation without adjustments to the natural conditions. Potential approach for use with other active remedial alternatives. Will likely be a component of any remedial alternative.	MNA does not require infrastructure installation except for a network of new monitoring points if needed. It does not rely on delivery of amendments to subsurface. There is no O&M, other than monitoring well maintenance and no waste stream other than purge water from sampling events.	Even with good conditions, MNA takes a longer time to achieve PRGs than other more aggressive remedies. MNA is limited by naturally existing physical, biological, and geochemical processes, unless used in combination with an enhancement remedy (e.g., ERD). Native geochemical and biological conditions may not be sufficient to completely reduce the contaminant source, so MNA relies on the slower diffusion and dispersion.	X	
Containment	Vertical barriers	Slurry wall, sheet piling, vibrating barrier wall, etc.	Physical subsurface barrier (potentially involving a chemical treatment option) to contain/prevent contaminated groundwater flow.	✔✔	✔✔	✔✔	✔✔	✔✔	✔✔	Isolates and/or contains contamination; therefore effective for [preventing migration of] most contaminants.	Effective for limiting mobility and impacted media volume through containment. Effective technology when combined with in situ or ex situ remediation process options.	Containment of the plume will not achieve all RAOs. Technically impracticable to install wall deep and wide enough to contain impacted groundwater plume. Can disturb subsurface which may temporarily mobilized some contaminants. Slows or stops natural attenuation.		X

Table 4-2a
<u>Primary</u> Screening of Groundwater Remediation Technologies and Process Options
Feasibility Study
Operable Unit 14, Site 90
MCAS Cherry Point, North Carolina

General Response Action	Remedial Technology	Process Options	Description	Target Contaminant Class						Comments	Advantages	Disadvantages	Primary Screening	
				Hydrocarbons										
				VOCs	Non-VOCs	SVOCs	CVOCs**, Chlorinated Pesticides	Nutrients	Metals and Radio-nuclides				Retain	Reject
Removal	Extraction	Vertical or horizontal extraction wells	Series of wells to extract contaminated groundwater. Drilling techniques are used to position wells vertical or horizontally, or at an angle, to reach contaminants not accessible (beneath buildings) by direct vertical drilling.	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	Effective for soluble to semi-soluble contaminants such as VOCs, metals, nutrients and in some cases LNAPL where removal is reasonably effective. Will work with site COCs.	This is a conventional and well-established technology that can be used with in situ technologies or to provide hydraulic control of plumes. It can be combined with a wide range of different technologies specific to the contaminants present in the groundwater. Hydraulic control of groundwater can limit the contaminant migration.	This is not always effective for the removal of contaminants. Typically not cost-effective. It may require long-term operation at some sites, especially if it is a stand-alone remedy. Operations and maintenance are required. It is generally less effective for low permeability soils. Costs can be high if long-term operations are needed. Undesirable alternative per Navy policy. Low sustainability ranking.	X	
		Collection trenches	Perforated pipe in trenches backfilled with porous media to collect water.	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	Same as vertical or horizontal extraction wells	Same as vertical or horizontal extraction wells	Same as vertical or horizontal extraction wells; Site utility density and airfield operations preclude trenching technologies at OU14.		X
Treatment (In situ)	Chemical	In Situ Chemical Oxidation (ISCO)	Oxidant such as permanganate, hydrogen peroxide, persulfate, Fenton's reagent, or ozone is injected, which chemically oxidizes organic contaminants to less harmful or totally harmless compounds such as CO_2 and H_2O depending on the oxidant and the pH in the treatment zone.	✓✓	✓✓	✓✓	✓✓			ISCO is effective for readily oxidizable carbon-based compounds such as CVOCs (ethenes or ethanes), aromatic compounds, and some aliphatic compounds. ISCO only partially removes DNAPL, and at some sites cannot treat all DNAPL even with multiple treatment events. Also treats POL VOCs.	ISCO rapidly lowers high concentrations of dissolved organic compounds. Infrastructure and delivery of the oxidant uses proven and effective methods. Since the contaminants are destroyed, there are no hazardous intermediate degradation products. No waste is generated.	The effective placement of the oxidant is often difficult, and uniform distribution is more complex in heterogeneous or low-permeability materials. Subsurface fouling may occur due to deposition of oxides during oxidation reactions that can reduce ISCO effectiveness over time. Multiple rounds of injections may be required, and rebound of the dissolved-phase plume may occur after injections are finished. Unless the contaminant concentrations are low, ISCO alone will be unlikely to achieve PRGs. Large oxidant demand from POL would require high ISCO dosage to treat the CVOCs. Would require installation of high number of injection wells.		X
		Permeable Reactive Barrier (PRB)	Treats groundwater plume as it passes through a permeable reactive zone (natural or induced gradient). Reactive zone may be a combination of physical, chemical, and biological processes. May also include measures, such as low-permeability barriers, to channel groundwater towards treatment zone. Chemical reductants such as ZVI are typical PRB applications to treat CVOCs.	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	Several type of reactive media such as ZVI, lime, organic mulches, phosphate materials have been used to remove a wide range of contaminants. Chemical reductants such as ZVI are typical PRB applications to treat CVOCs. Elevated sulfates in the 100-1,000 mg/L range consume ZVI PRBs at a faster rate than CVOCs because of precipitation sulfide minerals.	PRB walls generally provide an effective method of isolating contaminants and preventing further downstream migration beyond the wall. No O&M is required (other than periodic replacement/recharge of spent material).	Thick, deep or long barriers can be very expensive. Deep barriers may be logistically difficult/impossible. Structures, property access, and utility conflicts can make continuous barriers difficult. Naturally occurring sulfates in the aquifer may consume the chemical reductant media at a greater rate than the contaminants, reducing the effectiveness over time. Site utility density and airfield operations preclude trenching technologies at OU14.	X	
		In Situ Chemical Reduction (ISCR)	Reduction agents (ZVI, polysulfide, dithionate, ferrous sulfate, etc.) to alter state, promote precipitate or form less soluble, more stable compounds.				✓✓	✓✓	✓✓	ISCR technology is similar to in situ bioremediation where reagents are injected into the subsurface using wells to treat CVOCs. (ISCR is also used for treatment of metals.). Elevated sulfate in the aquifer (>100 mg/L) significantly affects the performance of the chemical reductant PRB because of precipitation sulfide minerals.	There are no long-term O&M costs after installation.	Zero-valent iron can difficult to distribute uniformly in the subsurface. High naturally occurring sulfate concentrations may more effectively compete to consume the ZVI than the contaminants. Installation of many injection wells.	X	
	Physical treatment	Air Sparging (AS)	Air injected into groundwater through a system of vertical wells or horizontal perforated pipes to remove VOCs. May be combined with soil vapor extraction (SVE) to collect VOCs.	✓✓	✓✓	✓✓	✓			Mainly designed for VOCs (CVOCs included), this technology has proven effective when used with SVE (for vapor mitigation).	AS can be implemented with standard well constructions, and doesn't require specialized tools for installation or operation. Air is the only amendment introduced to the subsurface. No waste stream is generated other than recyclable activated carbon if SVE is also employed.	Applicability is limited to homogeneous, high-permeability aquifers. Subsurface air injection may mobilize the contaminant vapor plume which can aggravate indoor air vapor intrusion issues. High subsurface oxygen conditions can occur which may be counterproductive to anaerobic biodegradation processes requiring a reducing environment, but these CVOCs are still stripped.	X	

Table 4-2a
<u>Primary</u> Screening of Groundwater Remediation Technologies and Process Options
Feasibility Study
Operable Unit 14, Site 90
MCAS Cherry Point, North Carolina

General Response Action	Remedial Technology	Process Options	Description	Target Contaminant Class						Comments	Advantages	Disadvantages	Primary Screening	
				Hydrocarbons										
				VOCs	Non-VOCs	SVOCs	CVOCs**, Chlorinated Pesticides	Nutrients	Metals and Radio-nuclides				Retain	Reject
Treatment (In situ) (continued)	Physical treatment (continued)	Biosparging	Similar to AS: air or oxygen is introduced to stimulate aerobic degradation of hydrocarbons, PAHs and VOCs	✓✓	✓✓	✓✓	✓			For stimulating or enhancing aerobic biodegradation and inherently removing VOCs just like AS technology.	Primarily used for hydrocarbons. AS systems can be converted to biosparging systems. Very effective when combined with SVE.	Not effective for low-permeability soils. Requires maintenance and operation to maintain efficiency. High subsurface oxygen conditions can occur which may be counterproductive to anaerobic biodegradation processes requiring a reducing environment.	X	
		Dual-Phase Extraction (DPE)	Use of groundwater collection system to lower water table to expose soil. Soil vapor extraction is then used to removed absorbed or trapped contaminants.	✓✓	✓✓	✓✓	✓✓			Technology can be used to capture both aqueous and gaseous phases. Should be compared to a combination of groundwater extraction and SVE.	DPE combines the advantages of groundwater extraction with SVE. It can be used with in situ technologies for a more effective remedy. Hydraulic control and vapor control or groundwater can reduce volume, mass and limit migration of contaminants.	Not usually effective for low-permeability sites. Operations and maintenance are required. Some sites may require long term operation. This technology would address POL contamination more than the CVOC contamination	X	
		Hydraulic Fracturing (HF)	High-pressure injection of fluids, followed by granular slurry or *proppant*, to create subsurface fracture patterns that enhance injection material distribution, increase probability of COC contact and increase contact time.	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	A technology has been used to inject chemical reductants (e.g., ZVI) for CVOCs and metals, or organic substrates (e.g., emulsified edible oils), but can be used to enhance any injection for other contaminant groups. Fracturing methods are considered with the injection technologies. Should be compared to pneumatic fracturing.	A technology to enhance placement of reactive materials for remediation or can be used to inject sand to enhance recovery of water/vapor.	Control on placement of injected materials is limited. Multiple injections are often required if semi-uniform material placement is needed.	X	
		Pneumatic Fracturing (PF)	High-pressure injection of air or nitrogen to create self-propped subsurface fracture patterns that enhance injection material distribution, increase probability of COC contact and increase contact time. Also can complement vapor and fluid extraction technologies The fracturing extends and enlarges existing fissures and introduces new fractures, primarily in the horizontal direction.	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	A technology has been used to enhance injection distribution of chemical reductants (e.g., ZVI) for CVOCs and metals, or organic substrates (e.g., emulsified edible oils), but can be used to enhance any injection for other contaminant groups. Fracturing methods are considered with the injection technologies.	A technology to enhance distribution/placement of reactive materials for remediation.	Control on placement of injected materials is limited. Multiple injections are often required if semi-uniform material placement is needed.	X	
	Biological treatment	Enhanced Aerobic Bioremediation	Stimulation of indigenous microorganisms to degrade the chemical by injecting oxygen, nutrients, and/or substrates.	✓✓	✓✓	✓✓				Used primarily for hydrocarbons, oxygen generating compounds can be used, but additional nutrients such as nitrogen/phosphorus are added.	Supply of oxygen to increase aerobic degradation of less oxidized, less chlorinated compounds such as vinyl chloride.	Highly oxidized and highly chlorinated VOCs (PCE and TCE) will not be readily biodegraded under aerobic conditions. Not effective for low-permeability soils. Requires frequent injections/replacement of oxygen compounds and nutrients. Would be less effective for anaerobic environments with high TOC.	X	
		Enhanced Reductive Dechlorination (ERD)	Use of an organic substrate such as lactate, molasses, or vegetable oil to promote anaerobic biodegradation of CVOCs via reductive dechlorination pathway. Applied via injection or biomulch barrier wall.	✓			✓✓	✓	✓	ERD is effective for high concentrations of dissolved-phase CVOCs. It may substantially reduce DNAPL over a period of several years. Existing POL essentially performs ERD, but only if carbon/electrons are readily available -- ideal conditions at OU14 appear to be stalled.	ERD amendments have a long residence time in the subsurface, maximizing the contact with contaminants. Infrastructure and delivery of amendments uses proven and effective methods. Numerous amendments exist with cost-effective unit costs. No waste is generated.	ERD requires relatively close injection spacing depending on site lithology and contaminant concentrations. Multiple rounds of amendments may be required, depending on initial contaminant concentrations and the rate of reductive dechlorination. Intermediate degradation products are generated which may adversely impact vapor intrusion. The reaction kinetics may stall, leading to a buildup of intermediate products.	X	
		Bioaugmentation	Typically only conducted if ERD alone does not meet RAOs. Bioaugmentation is the injection of contaminant-specific nonindigenous native or engineered microorganisms to the subsurface to promote biodegradation.				✓✓			Commonly used for chlorinated ethenes. New cultures are available for chlorinated ethanes and methanes. Typically not necessary on the East Coast of the U.S. (indigenous dehalogenating bacteria are typically present throughout).	Effective for sites that lack capability of complete dechlorination.	Usually requires a two step process to evaluate and implement. Cultures require specific geochemical conditions before injection of cultures can be conducted.	X	

Table 4-2a
<u>Primary</u> Screening of Groundwater Remediation Technologies and Process Options
Feasibility Study
Operable Unit 14, Site 90
MCAS Cherry Point, North Carolina

General Response Action	Remedial Technology	Process Options	Description	Target Contaminant Class						Comments	Advantages	Disadvantages	Primary Screening	
				Hydrocarbons										
				VOCs	Non-VOCs	SVOCs	CVOCs**, Chlorinated Pesticides	Nutrients	Metals and Radio-nuclides				Retain	Reject
Treatment (In situ) (continued)	Biological treatment (continued)	MNA	Natural attenuation (all mechanisms including biodegradation, advection-dispersion, dilution, etc.) coupled with regular monitoring for the COCs as well as for other indicators of biodegradation.	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	Physical, biological and geochemical conditions must be suitable for attenuation without adjustments to the natural conditions. Potential approach for use with other active remedial alternatives, especially ERD. Will likely be a component of any remedial alternative.	MNA does not require infrastructure installation except for a network of monitoring points. It does not rely on delivery of amendments to subsurface. There is no O&M, other than monitoring well maintenance. Waste stream includes soil cuttings from well installations and purge water from development and sampling events.	Even with good conditions, MNA alone takes a longer time to achieve PRGs than other more aggressive remedies. MNA is limited by naturally existing physical, biological, and geochemical processes. Native geochemical and biological conditions may not be sufficient to completely reduce the contaminant source, so MNA relies on the slower diffusion and dispersion.	X	
		Phytoremediation	Use of plants, grasses, and trees to remove and transform or evapotranspire contaminants. Also for hydraulic control.	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	Water table (and entire depth of contamination) needs to be within reach of plant roots. Geologic confining layer must be within influence of plant groundwater extraction for hydraulic control or contaminant sequestration.	Phytoremediation and wetland systems are self-sustaining. However, OU14 is a paved active airfield.	OU14 is paved airfield. This technology cannot be applied at OU14.		X
Treatment (Ex situ)	Chemical treatment	Chemical oxidation	Contaminated water mixed with an oxidant, such as hydrogen peroxide, permanganate, ozone, to destroy the organic compounds.	✓	✓	✓	✓			Similar to in situ applications, but less commonly used for ex situ treatment. Requires pump and treat for groundwater capture and recovery.	Good control of dosing and treatment efficacy. Destroys or alters organic contaminants to less toxic or non-toxic forms.	Requires pump and treat for groundwater capture and recovery. Requires significant operation and maintenance oversight to ensure desired results. Cost usually higher than other more common ex situ treatment methods (such as activated carbon). Lower sustainability ranking.		X
		Chemical Reduction	Reduction agents added to wastes for reduction of hexavalent chromium, mercury, dissolved lead, and silver to less soluble, more stable forms.				✓✓		✓	Ferrous chloride/sulfate, ZVI, sulfur modified iron, dithionite can be used to reduce metals and some organic compounds to degrade, precipitate or remove by filtration. Requires pump and treat for groundwater capture and recovery.	This treatment reduces the toxicity, volume and mass of impacted water. It is an established technology available to a wide range of contaminants, and is generally acceptable to regulators.	Requires pump and treat for groundwater capture and recovery. The cost for running this technology over a long term can be high. Operations and maintenance are required. Long-term operation may be required at some sites. Lower sustainability ranking.	X	
	Physical Treatment	Ion exchange, Precipitation and Filtration	Physical removal and a change chemical equilibrium to reduce solubility of contaminants, usually metals. Precipitates are separated from water by an applied pressure which forces water through the filter while retaining solids.					✓	✓✓	Not applicable for site COCs. Requires pump and treat for groundwater capture and recovery. A wide range of ion exchange resins and chemicals can be used to treat a wide range of contaminants. However,	Well established technologies that can treat a variety of ionizable metals and some nutrients. Effective for both cationic and anionic compounds	Not applicable for site COCs. Requires pump and treat for groundwater capture and recovery. The cost for running this technology over a long term can be high. Operations and maintenance are required. Long-term operation may be required at some sites.		X
		Air stripping	Large volumes of air mixed with water in a packed column to promote transfer of VOCs to air.	✓✓			✓✓			Requires pump and treat for groundwater capture and recovery.	This treatment reduces the toxicity, volume and mass of impacted water. It is an established technology available to a wide range of contaminants, and is generally acceptable to regulators.	Requires pump and treat for groundwater capture and recovery. Pump and treat is not effective in heterogeneous, low permeability materials. The cost for running this technology over a long term can be high. Operations and maintenance are required. Long-term operation may be required at some sites.	X	
		Electrical Resistive Heating	Involves installation of electrodes in hexagonal or three point arrays and application of high voltage electrical power to cause boiling of volatile compounds in groundwater. Volatilized compounds are removed by SVE, treated, and discharged under permit.	✓✓			✓✓			High energy and H&S issues during implementation. But applicable for both COCs and POL contaminants.	Effectively removes volatiles quickly.	Cost prohibitive and technically challenging due to depth and extent of contamination. Requires follow-on ex situ treatment. Extensive network of heating points and electrical wiring would be required. Very high power consumption - low sustainability ranking. Human health risk elevated during operation due to increased vapor.	X	
		Carbon adsorption	Contaminants adsorbed onto activated carbon by passing contaminated water or air through a carbon column.		✓		✓			Requires pump and treat for groundwater capture and recovery.	Established, widely- used treatment train process.	Ex situ treatment and siting equipment on active airfield is undesirable. Replacement/reactivation of carbon throughout treatment.	X	

Table 4-2a
Primary Screening of Groundwater Remediation Technologies and Process Options
Feasibility Study
Operable Unit 14, Site 90
MCAS Cherry Point, North Carolina

General Response Action	Remedial Technology	Process Options	Description	Target Contaminant Class						Comments	Advantages	Disadvantages	Primary Screening	
				Hydrocarbons										
				VOCs	Non-VOCs	SVOCs	CVOCs**, Chlorinated Pesticides	Nutrients	Metals and Radio-nuclides				Retain	Reject
Disposal	Discharge of treated groundwater	Wastewater treatment system/plant	Treated groundwater discharged to municipal or industrial wastewater treatment system.							First, the contaminated groundwater must be pumped/extracted, stored, and then transported to the IWTP. Can be beneficial to both parties if tertiary treatment is needed and addition flow needed at plant. All Air Station nonhazardous IDW water is disposed and managed by the IWTP. The disposal method of treated groundwater is not a factor for this FS.	Can be convenient method of treated water discharge. Potential portion of an extraction alternative. Air Station's IWTP can be used at reduced cost.	Does not in itself meet RAOs. New pipeline to IWTP is needed or numerous tanker trips. Extraction of groundwater is undesirable alternative.	X	
		Reuse	Use treated groundwater for facility or off-site use.							First, the contaminated groundwater must be pumped/extracted, stored, and then transported to the IWTP. In some cases can be used for agricultural irrigation of wetland habitat. All Air Station nonhazardous IDW water is disposed and managed by the IWTP. The disposal method of treated groundwater is not a factor for this FS.	Effective water reuse method. May qualify for water credits. Potential portion of an extraction alternative.	Does not in itself meet RAOs. Requires permitting (more ARAR compliance) for discharge to habitat. Extraction of groundwater is undesirable alternative.		X
		Recharge	Recharge of treated groundwater to the contaminated aquifer via injection wells or infiltration trench.							First, the contaminated groundwater must be pumped/extracted, stored, and then transported to the IWTP. Treated water can be recharged to groundwater where water is scarce. All Air Station nonhazardous IDW water is disposed and managed by the IWTP. The disposal method of treated groundwater is not a factor for this FS.	Effective water reuse method. May qualify for water credits. Potential portion of an extraction alternative.	Does not in itself meet RAOs. Requires permitting (more ARAR compliance). Extraction of groundwater is undesirable alternative. Follow-on handling and injection logistics.		X
		Surface water	Treated groundwater discharged into a nearby River.							First, the contaminated groundwater must be pumped/extracted, stored, and then transported to the IWTP. Most common treated water discharge point. The disposal method of treated groundwater is not a factor for this FS.	Common method and permitting needs are well established. Potential portion of an extraction alternative.	Does not in itself meet RAOs. Requires permitting (more ARAR compliance) for discharge. Extraction of groundwater is undesirable alternative.		X

Notes:

** Chlorinated Volatile Organic Compounds (CVOCs) are the CERCLA Chemicals of Concern (COCs) in Surficial Aquifer groundwater at OU14. The UST Program is addressing petroleum, oil, and lubricant (POL) dissolved-phase contamination (e.g., benzene and other POL constituents) and free product (FP) at OU14.

✓ - indicates that the technology has been proven effective for at least a portion of the chemical class at a number of sites

✓✓ - indicates technology is commonly used

Table 4-2b
<u>Secondary</u> Screening of Groundwater Remediation Technologies and Process Options
Feasibility Study
Operable Unit 14, Site 90
MCAS Cherry Point, North Carolina

General Response Action	Remedial Technology	Process Options	Description	Primary Screening		Secondary Screening			
				Retain	Reject	Effectiveness	Implementability	Relative Cost	Screening comments
No Action	None	Not applicable	No action provided. This process option is retained to provide the basis for comparing active process options and technologies.	X		None	Not applicable	Not applicable	**Retained** to provide basis of comparison to other process options and remediation technologies.
Institutional Controls	Administrative restrictions	Land-Use Controls (LUCs) / Deed Restrictions and notices	LUCs issued for property within potentially contaminated areas to restrict property use and well installation.	X		Effective in protecting human health given consistent implementation (i.e., enforcement of no drinking well installations or no construction prior to vapor intrusion evaluations until cleanup levels are met).	Easy. No current drinking wells at OU14. Use of *Navy LUC Tracker* tool.	Very low.	**Retained.** Will be implemented with other alternatives.
	Access restrictions	Fences	Security fences installed around potentially contaminated areas to limit access.		X	Effective at limiting site access, but does not physically prevent exposure to groundwater.	Easy to implement. Security already implemented at facility.	Low.	Not retained for evaluation. Security measures are already in place.
	Alternative Drinking Water Source	Cisterns or Tanks	Drinking water is dispensed to users from a central point.		X	Very effective at protecting human health by providing alternate drinking water source.	Easy to Moderate.	Low, but long-term cost for O&M.	An alternate drinking water source is not needed.
		Bottled Water	Drinking water is obtained from a commercial vendor.		X		Easy	Medium - purchasing bottled water in perpetuity.	
		Deeper or Upgradient Wells	Wells are installed deep or upgradient if these areas are isolated from contamination.		X		Easy to Moderate.	Low.	
		Municipal Water Supply	Additional water sources are established.		X		Already implemented.	No cost.	
Monitoring	Sampling	Performance and Compliance Monitoring	Sample media containing COCs and/or media at points of compliance.	X		Provides performance and compliance monitoring data.	Easily implemented. Generate monitoring plan and sample on established schedule.	Low, but long-term cost until cleanup levels are met.	**Retained.** Necessary component of any alternative.
	Monitored Natural Attenuation (MNA)	Intrinsic process and Performance Monitoring	Natural attenuation (all mechanisms including biodegradation, advection-dispersion, dilution, etc.) coupled with regular monitoring for the COCs as well as for other indicators of biodegradation.	X		Effective for sites such as this where there are no unacceptable current risks (no exposure) and future risks are minimal.	Easily implemented, only monitoring well installation and sampling would be required to monitor the progress.	Low, but long-term cost until cleanup levels are met.	**Retained.** Other alternatives may include MNA as a component.
Containment	Vertical barriers	Slurry wall, sheet piling, vibrating barrier wall, etc.	Physical subsurface barrier (potentially involving a chemical treatment option) to contain/prevent contaminated groundwater flow.		X	Can be effective for isolating source areas, but not effective for dissolved-phase contaminants.	Can be implemented in fine porous media to depths of 30 to 60 feet bgs using conventional construction, deeper using injection methods. However, walls cannot be considered because of site operations and utility density (Figure 2.2).	Moderate to high depending on area and volume requirements.	Not retained. COC plumes are large. Stops or slows natural attenuation (no treatment).

Table 4-2b
<u>Secondary</u> Screening of Groundwater Remediation Technologies and Process Options
Feasibility Study
Operable Unit 14, Site 90
MCAS Cherry Point, North Carolina

General Response Action	Remedial Technology	Process Options	Description	Primary Screening		Secondary Screening			
				Retain	Reject	Effectiveness	Implementability	Relative Cost	Screening comments
Removal	Extraction	Vertical or horizontal extraction wells	Series of wells to extract contaminated groundwater. Drilling techniques are used to position wells vertical or horizontally, or at an angle, to reach contaminants not accessible (beneath buildings) by direct vertical drilling.	X		Extraction wells may serve two purposes: containment by hydraulic control and removal of contaminated groundwater.	Easily implemented in area with moderate to high permeability. Well installations will be difficult considering utilities and active installation logistics. Long-term O&M and water treatment or disposal.	High	Not retained. Groundwater extraction is generally undesirable to Navy and DOD based on historical implementation and O&M experience and optimization lessons-learned. Long-term O&M, high cost, and frequent optimizations.
		Collection trenches	Perforated pipe in trenches backfilled with porous media to collect water.		X	More effective than wells in areas of very low or variable permeability.	Utilities will preclude this technology.	High	
Treatment (In situ)	Chemical	In Situ Chemical Oxidation (ISCO)	Oxidant such as permanganate, hydrogen peroxide, persulfate, Fenton's reagent, or ozone is injected, which chemically oxidizes organic contaminants to less harmful or totally harmless compounds such as CO_2 and H_2O depending on the oxidant and the pH in the treatment zone.		X	Theoretically effective, but requires good contact between contaminant and reagent. Aquifer heterogeneity would make uniform distribution difficult and would limit effectiveness. Multiple implementations would be required due to plume size, and also because the POL VOCs would be treated (consume the oxidant) at the same time as the CVOCs.	Difficult to implement and achieve good distribution/mixing in situ. Would require multiple injections. Well installations will be difficult considering utilities and active airfield logistics.	Very High considering size of plumes and additional oxidant demand from the POL at the site. Oxidation not cost-effective on dilute dissolved VOC plumes in the presence of POL. Multiple injections would be required.	Not retained. Plumes are too large with relatively low CVOC concentration plumes commingled with POL, which would also consume the oxidant, resulting in increased reinjections, to make ISCO cost-effective.
		Permeable Reactive Barrier (PRB)	Treats groundwater plume as it passes through a permeable reactive zone (natural or induced gradient). Reactive zone may be a combination of physical, chemical, and biological processes. May also include measures, such as low-permeability barriers, to channel groundwater towards treatment zone. Chemical reductants such as ZVI are typical PRB applications to treat CVOCs.	X		Extremely effective in treating CVOCs. Iron media may foul after some time (10 to 30 years) and require replacement every 20 years. Natural sulfate in the aquifer consumes the reactive media more rapidly (elevated sulfate concentrations at OU14). Spacing subject to plume size and groundwater travel time.	Installation will prove difficult because of utility density (Figure 2.2) and airfield operations. Increased replacement of PRB materials in the future because of sulfate concentrations at OU14. Replacement of PRB materials also affected by time to remediation.	High cost. Costs include wall construction, iron material purchase, trench soils disposal. Future wall replacement every 20 years at sites where sulfate is not an issue; however, elevated sulfate concentrations are evident throughout OU14.	Not retained. Continuous PRBs cannot be installed at OU14 because of site operations, buildings, and utility density. Also, elevated sulfate in the aquifer would consume the chemical reductant at a more rapid rate than the CVOCs and result in numerous replacements, make PRBs not cost-effective.
		In Situ Chemical Reduction (ISCR)	Reduction agents (ZVI, polysulfide, dithionate, ferrous sulfate, etc.) to alter state, promote precipitate or form less soluble, more stable compounds.	X		Extremely effective in treating CVOCs. Injection point spacing subject to plume size. Would require increased rate of reinjections due to the elevated sulfate concentrations (>100 mg/L) throughout OU14. Spacing subject to plume size and groundwater travel time	Would require many injection points. Increased rate of reinjections due to elevated sulfate in the aquifer. Multiple temporary DPT injections points would be needed rather than permanent injection points (because open borehole injection wells could not be maintained long-term due to the sandy materials at OU14). Numerous injection points would prove difficult considering utilities and active airfield logistics.	Moderately High. Costs include injection well construction, iron material purchase, injection process, and potential reinjection.	Not retained. Elevated sulfate in the aquifer would consume the chemical reductant at a more rapid rate than the CVOCs and result in numerous reinjections using non-permanent injection points, making ISCR not cost-effective
	Physical treatment	Air Sparging (AS)	Air injected into groundwater through a system of vertical wells or horizontal perforated pipes to remove VOCs. May be combined with soil vapor extraction (SVE) to collect VOCs.	X		Extremely effective in treating CVOCs by stripping. Enhances aerobic conditions for aerobic biodegradation of vinyl chloride. Spacing subject to plume size and groundwater travel time.	Increased number of well installations, including horizontal drilling. Conveyance piping and wiring will be difficult considering utilities and active airfield logistics. Horizontal drilling installs the well underneath the utilities. Indoor air vapor mitigation systems (passive or active) or SVE may be necessary depending on building occupancy.	Medium-High considering size of plumes and increased capital expenses for equipment and long-term costs for O&M until cleanup levels are met. Horizontal drilling techniques are well-established.	Not Retained. Stripping mechanism of sparging to be evaluated as "Biosparge." Higher airflow rates associated with AS may increase or cause indoor air vapor issues. Only Biosparge, which consists of a lower airflow rate, and an emphasis on enhancing aerobic biodegradation, will be evaluated.

General Response Action	Remedial Technology	Process Options	Description	Primary Screening		Secondary Screening			
				Retain	Reject	Effectiveness	Implementability	Relative Cost	Screening comments
Treatment (In situ) (continued)	Physical treatment (continued)	Biosparging	Similar to AS: air or oxygen is introduced to stimulate aerobic degradation of hydrocarbons, PAHs and VOCs	X		Same technology as AS, but uses a lower airflow rate to both strip VOCs and enhance aerobic biodegradation. Especially effective in treating less-chlorinated CVOCs such as vinyl chloride. Spacing subject to plume size and groundwater travel time.	Increased number of well installations, including horizontal drilling. Conveyance piping and wiring will be difficult considering utilities and active airfield logistics. Horizontal drilling installs the well underneath the utilities. Cycling on and off reduces O&M/costs. Indoor air vapor mitigation systems (passive or active) or SVE may be necessary depending on building occupancy.	Medium-High considering size of plumes and increased capital expenses for equipment and long-term costs for O&M until cleanup levels are met. Horizontal drilling techniques are well-established.	**Retained.**
		Dual-Phase Extraction (DPE)	Use of groundwater collection system to lower water table to expose soil. Soil vapor extraction is then used to removed absorbed or trapped contaminants.	X		Combination with complementary technologies (e.g., pump-and-treat). Use of DPE with these technologies can shorten the cleanup time at a site, as the capillary fringe is often the most contaminated area. Spacing subject to plume size and groundwater travel time	DPE is a full scale technology and commercially available. Well installations will be difficult considering utilities and active airfield logistics.	High. Because of the number of variances involved, establishing general costs for DPE is difficult.	Not retained. Groundwater extraction is generally undesirable based on Navy experience.
		Hydraulic Fracturing (HF)	High-pressure injection of fluids, followed by granular slurry or *proppant* , to create subsurface fracture patterns that enhance injection material distribution, increase probability of COC contact and increase contact time.	X		Fracturing is an enhancement technology designed to increase the efficiency delivery of the injected materials. However, the native materials at OU14 are relatively clean sands, so this enhancement is not needed.	Fracturing is widely used innovative injection process. May damage nearby utilities. Any intrusive work will be a challenge considering utility density and active airfield logistics.	Low-Medium in itself - Part of the required injection cost.	Not retained. Native materials at OU14 are relatively clean sands, so this enhancement is not needed.
		Pneumatic Fracturing (PF)	High-pressure injection of air or nitrogen to create self-propped subsurface fracture patterns that enhance injection material distribution, increase probability of COC contact and increase contact time. Also can complement vapor and fluid extraction technologies The fracturing extends and enlarges existing fissures and introduces new fractures, primarily in the horizontal direction.	X		Fracturing is an enhancement technology designed to increase the efficiency delivery of the injected materials. However, the native materials at OU14 are relatively clean sands, so this enhancement is not needed.	Fracturing is widely used innovative injection process. May damage nearby utilities. Any intrusive work will be a challenge considering utility density and active airfield logistics.	Low-Medium in itself - Part of the required injection cost.	Not retained. Native materials at OU14 are relatively clean sands, so this injection enhancement is not needed.
	Biological Treatment	Enhanced Aerobic Bioremediation	Stimulation of indigenous microorganisms to degrade the chemical by injecting oxygen, nutrients, and/or substrates.	X		Not effective for the most-chlorinated, highly oxidized CVOCs such as PCE and TCE. However, aerobic biodegradation of less-chlorinated DCE and vinyl chloride is an established technology. This will be considered under the Biosparge process options.	Not applicable	Not applicable	Not retained. Treats less-chlorinated CVOCs vinyl chloride, DCA, and DCE), but does not treat PCE and TCE effectively. Oxygen addition is considered under Biosparging.
		Enhanced Reductive Dechlorination (ERD)	Use of an organic substrate such as lactate, molasses, or vegetable oil to promote anaerobic biodegradation of CVOCs via reductive dechlorination pathway. Applied via injection or biomulch barrier wall.	X		Established technology, proven to be effective for sites with high to moderate permeability. Less effective in soils of variable permeability because it is difficult to obtain even distribution of substrate. Injection well 'biowall' configuration works well on dissolved-phase plume.	Relatively straight forward, well-established. But would require many injection well installations. Well installations and injection events will be difficult considering utilities and active airfield logistics. Biomulch walls cannot be considered because of site operations and utility density (Figure 2-2).	Medium-High considering size of plumes. Considered cost-effective in general for sites, and is cheaper than chemical treatment technologies and conventional Pump and Treat systems.	**Retained.** Note: Only permanent injection wells considered for cost-effectiveness and implementability due to anticipated multiple injections.
		Bioaugmentation	Typically only conducted if ERD alone does not meet RAOs. Bioaugmentation is the injection of contaminant-specific nonindigenous native or engineered microorganisms to the subsurface to promote biodegradation.	X		Very effective for CVOC biodegradation coupled with ERD, but likely not necessary.	Easily implemented. Added to injected material or injected separately / during separate injection event.	Low, but still an additional cost that is likely not necessary.	**Retained.** To be considered as part of the ERD alternative, but likely not necessary for this site.

Table 4-2b
<u>Secondary</u> Screening of Groundwater Remediation Technologies and Process Options
Feasibility Study
Operable Unit 14, Site 90
MCAS Cherry Point, North Carolina

General Response Action	Remedial Technology	Process Options	Description	Primary Screening		Secondary Screening			
				Retain	Reject	Effectiveness	Implementability	Relative Cost	Screening comments
Treatment (In situ) (continued)	Biological Treatment (continued)	MNA	Natural attenuation (all mechanisms including biodegradation, advection-dispersion, dilution, etc.) coupled with regular monitoring for the COCs as well as for other indicators of biodegradation.	X		Effective for sites such as this where there are no unacceptable current risks (no exposure) and future risks are minimal (ongoing Marine Corps base mission).	Easily implemented. Only substrate injection wells and monitoring would be required to monitor the progress.	Low	**Retained.**
		Phytoremediation	Use of plants, grasses, and trees to remove and transform or evapotranspire contaminants. Also for hydraulic control.		X	Not applicable at OU14.	Not applicable	Not applicable	Not retained. Cannot be applied at OU14 because the site is a paved airfield.
Treatment (Ex situ)	Chemical treatment	Chemical oxidation	Contaminated water mixed with an oxidant, such as hydrogen peroxide, permanganate, ozone, to destroy the organic compounds.		X	Effective for most CVOCs. However, lower efficacy for DCAs.	Difficult to implement because of siting equipment and O&M. Groundwater extraction is generally undesirable compared to in situ treatment.	High. Extraction cost plus the treatment cost, followed by disposal or re-use handling.	Not retained. Extraction of groundwater is undesirable. Unnecessarily higher cost.
		Chemical Reduction	Reduction agents added to wastes for reduction of hexavalent chromium, mercury, dissolved lead, and silver to less soluble, more stable forms.	X		Effective for CVOCs. Direct abiotic destruction of CVOCs to innocuous compounds (no daughter products).	Difficult to implement because of siting equipment and O&M. Groundwater extraction is generally undesirable compared to in situ treatment.	High. Extraction cost plus the treatment cost, followed by disposal or re-use handling.	Not retained. Extraction of groundwater is undesirable. Unnecessarily higher cost.
	Physical Treatment	Ion exchange, Precipitation and Filtration	Physical removal and a change chemical equilibrium to reduce solubility of contaminants, usually metals. Precipitates are separated from water by an applied pressure which forces water through the filter while retaining solids.		X	Not applicable for site COCs.	Not applicable	Not applicable	Not retained. Not applicable for site COCs.
		Air stripping	Large volumes of air mixed with water in a packed column to promote transfer of VOCs to air.	X		Very effective. Generally over 95% removal of VOCs.	Requires permitting for NPDES discharge or handling to get water to MCAS Cherry Point IWTP.	Moderate.	Not retained. Extraction of groundwater is undesirable. Unnecessarily higher cost.
		Electrical Resistive Heating	Involves installation of electrodes in hexagonal or three point arrays and application of high voltage electrical power to cause boiling of volatile compounds in groundwater. Volatilized compounds are removed by SVE, treated, and discharged under permit.	X		Very effective.	Utilities will prove difficult. Active airfield logistics.	High.	Not retained. Very high cost. Logistically very difficult due to normal site operations.
		Carbon adsorption	Contaminants adsorbed onto activated carbon by passing contaminated water or air through a carbon column.	X		Very effective for treatment of most VOCs. Carbon demand is reliant on groundwater flow rate and concentration of VOCs.	Widely used treatment technology. Would require extraction of groundwater.	Moderate to high. There are costs to regenerate and replace GAC.	Not retained. Extraction of groundwater is undesirable. Unnecessarily higher cost for ex situ treatment and periodic carbon regeneration.

Table 4-2b
<u>Secondary</u> Screening of Groundwater Remediation Technologies and Process Options
Feasibility Study
Operable Unit 14, Site 90
MCAS Cherry Point, North Carolina

General Response Action	Remedial Technology	Process Options	Description	Primary Screening		Secondary Screening			
				Retain	Reject	Effectiveness	Implementability	Relative Cost	Screening comments
Disposal	Discharge of treated groundwater	Wastewater treatment system/plant	Treated groundwater discharged to municipal or industrial wastewater treatment system.	X		Disposal is inherently effective because of the treatment performed.	Easy in itself. Potential portion of an extraction alternative.	The cost of a direct line to be installed, or transport by other method, to the MCAS Cherry Point IWTP and associated treatment costs at the IWTP.	The disposal method of treated groundwater is not a technology or process option that needs to be evaluated in the OU14 FS. All nonhazardous groundwater/IDW is disposed and managed by the Air Station's IWTP. In addition, disposal of treated groundwater is inherently part of a groundwater extraction technology and process option, which is generally undesirable for the Navy and DOD based on historical implementation, O&M, and frequent optimization requirements. Additional ARAR compliance associated with reuse and recharge is also undesirable.
		Reuse	Use treated groundwater for facility or off-site use.		X	Re-use after treatment is effective.	Easy in itself, not considering the additional ARAR compliance. Potential portion of an extraction alternative.	Low.	
		Recharge	Recharge of treated groundwater to the contaminated aquifer via injection wells or infiltration trench.		X	Re-use after treatment is effective.	Easy in itself, not considering the additional ARAR compliance. Potential portion of an extraction alternative.	Potentially costly to install injection/recharge wells.	
		Surface water	Treated groundwater discharged into a nearby River.		X	Re-use after treatment is effective.	Easy in itself, not considering the additional ARAR compliance. Potential portion of an extraction alternative.	Low.	

<u>Notes:</u>

** Chlorinated Volatile Organic Compounds (CVOCs) are the CERCLA Chemicals of Concern (COCs) in Surficial Aquifer groundwater at OU14. The UST Program is addressing petroleum, oil, and lubricant (POL) dissolved-phase contamination (e.g., benzene and other POL constituents) and free product (FP) at OU14.

Effectiveness is the ability to perform as part of an overall alternative that can meet the objective under conditions and limitations that exist onsite

Implementability is the likelihood that the process could be implemented as part of the remedial action plan under the physical, regulatory, technical, and schedule constraints.

Relative cost is for comparative purposes only and it is judged relative to the other processes and technologies that perform similar functions.

Table 4-3
Summary of Technologies and Process Options Retained for Development and Evaluation
Operable Unit 14, Site 90 Feasibility Study
MCAS Cherry Point, North Carolina

General Response Action (GRA)	Remedial Technology Type	Process Option	Description	Area of Consideration
No Action	None	Not Applicable.	No action provided. This process option is retained to provide the basis for comparing active process options and technologies.	This will provide a basis of comparison to other process options and remediation technologies.
Institutional Control	Administrative restrictions	Land-Use Controls (LUCs) (or Deed Restrictions and notices)	LUCs issued for property within potentially contaminated areas to restrict property use and well installation. DOD does not deed-restrict federal property; however, if property is transferred to non-Federal entity in the future before cleanup levels are met, a deed restriction would be necessary. The Navy developed and deployed a Web-based management tool, *LUC Tracker*, as part of the Naval Installation Restoration Information System (NIRIS).	Groundwater PRG Attainment Area boundaries. Applies to exposure to COCs in groundwater and potential indoor air vapor in any new or modified buildings resulting from COCs in groundwater.
Monitoring	Sampling	Performance and Compliance Monitoring	Sample media containing COCs and/or media at points of compliance.	Groundwater PRG Attainment Area boundaries (performance groundwater monitoring). Possible monitoring in the unnamed stream (sediment and surface water) during remedy. Performed with any process option until RAOs are achieved.
	Monitored Natural Attenuation (MNA)	Intrinsic process and Performance Monitoring	Natural attenuation (all mechanisms including biodegradation, advection-dispersion, dilution, etc.) coupled with regular monitoring for the COCs as well as for other indicators of biodegradation.	Sample network throughout the Groundwater PRG Attainment Areas boundaries, upgradient, and downgradient. Standalone alternative or in combination with another technology. Also considered a process option of the Biological Treatment technology type.
Treatment (In Situ)	Physical Treatment	Biosparging	Air is injected into groundwater through a system of vertical wells and/or horizontal perforated pipes to remove VOCs. The introduction of air or oxygen (at a lower airflow rate as compared to Air Sparging) stimulates aerobic degradation of hydrocarbons, PAHs, and VOCs. May be combined with soil vapor extraction (SVE) or indoor air vapor mitigation systems if necessary (lower airflow rate of biosparge [as compared to Air Sparging] reduces this potential vapor issue).	Biosparge wells in horizontal orientation throughout the CVOC plumes based on groundwater and contaminant travel and contact time.
	Biological Treatment	Enhanced Reductive Dechlorination (ERD)	Use of an organic substrate such as lactate, molasses, or vegetable oil to promote anaerobic biodegradation of CVOCs via reductive dechlorination pathway.	Injection wells in grid-like pattern for any 'hot spot" application and injection well barrier wall configuration throughout dissolved-phase plumes (based on groundwater travel time and contaminant contact time).
		Bioaugmentation	Typically only conducted if ERD alone does not meet RAOs. Bioaugmentation is the injection of contaminant-specific nonindigenous native or engineered microorganisms to the subsurface to promote biodegradation.	Optional component of ERD remedy (potentially component of MNA remedy). Likely not necessary at OU14 (presence of daughter products provides evidence of reductive dechlorination by indigenous dehalogenating bacteria).
		Monitored Natural Attenuation (MNA)	Natural attenuation (all mechanisms including biodegradation, advection-dispersion, dilution, etc.) coupled with regular monitoring for the COCs as well as for other indicators of biodegradation.	Sample network throughout the Groundwater PRG Attainment Areas boundaries, upgradient, and downgradient. Standalone alternative or in combination with another technology.

SECTION 5

Development and Description of Alternatives

This section presents a description of remedial alternatives developed for management or treatment of COCs in Surficial Aquifer groundwater at OU14. In accordance with EPA (1988), remedial alternatives were developed by assembling remedial technologies and representative process options after the initial screening process (Section 4). Remedial alternatives were developed based on site-specific considerations primarily related to the nature of the COCs and their concentration, and site hydrogeologic conditions.

The remedial alternatives developed and discussed in this section are as follows:

- Alternative 1—No Action
- Alternative 2—LUCs
- Alternative 3—MNA and LUCs
- Alternative 4—Biosparge, MNA, and LUCs
- Alternative 5—ERD, MNA, and LUCs

5.1 Common Remedial Alternative Components

This section describes those components that are common to all or most of the remedial alternatives. These common remedial components include groundwater sampling to collect additional site data for the RD, a multi-media monitoring program, construction-derived materials and investigation-derived waste (IDW) handling, LUCs, and Five-Year Reviews.

5.1.1 Additional Wells and Baseline Groundwater Sampling

Either of Alternatives 3 (MNA), 4 (Biosparge), and 5 (ERD) would require the installation of additional monitoring wells (single wells and shallow/deep well pairs) and baseline sampling from existing and the newly installed monitoring wells. The additional monitoring wells would be installed in both the Upper and Lower Surficial Aquifer to collect data to further refine the design aspects of the selected alternative (e.g., injection dosage and depth; temporal data to determine biodegradation rates for MNA) by confirming contaminant distribution and aquifer geochemistry conditions, establishing baseline conditions, and adding to the performance monitoring dataset. The assumptions regarding the details of well installation and sampling activities that were made in order to calculate the costs for each alternative are provided in Appendix C.

5.1.2 Performance Monitoring Program

Periodic sampling would be required as part of any remedial action until cleanup goals are met. Varying periods and frequencies of monitoring are appropriate for each alternative. The performance monitoring program for the selected remedy would be fully developed by the Partnering Team during the RD phase after the ROD is finalized, and would include an exit strategy for discontinuing the program when the cleanup levels are met. The

assumptions regarding the details of performance monitoring that were made in order to calculate the costs for each alternative are provided in Appendix C.

5.1.3 Construction- and Investigation-Derived Waste

All soil cuttings, purged groundwater, and decontamination fluids generated during remedial construction, implementation, and sampling are assumed to be (1) nonhazardous, (2) below regulatory standards for petroleum constituents, and (3) below other related special handling or disposal criteria. Full waste characterization would be performed prior to approved disposal: Aqueous material or waste would be characterized and disposed at the onbase IWTP or offsite as determined by the Air Station. Soil material or waste would be characterized and appropriately disposed offsite.

5.1.4 Five-Year Reviews

Five-Year Reviews would be required at OU14 (along with other sites at MCAS Cherry Point) until cleanup levels are met in the Surficial Aquifer groundwater. For the purposes of this FS, it was assumed that other sites at MCAS Cherry Point would also be included in the 5-year reviews (distributing the cost of the review between sites). Cost assumptions and details are provided in Appendix C for each alternative.

5.1.5 Land-Use Controls

In addition to stand-alone Alternative 2,LUCs are included as part of the remedial actions for Alternative 3 (MNA), 4 (Biosparge), and 5 (ERD). LUCs are used to support and enhance the remedial alternatives as appropriate (Section 4.3.2). The same objectives, implementation, and maintenance activities associated with LUCs pertain to all alternatives (with the exception of the No Action alternative). Cost assumptions and details are provided in Appendix C for each alternative.

5.2 Development of Remedial Alternatives for Surficial Aquifer Groundwater

5.2.1 Alternative 1—No Action

Description

The “No Action” alternative is required under CERCLA to be evaluated as a baseline for other alternatives. The ‘No Action’ alternative does not include any institutional controls, groundwater monitoring, or active remedial activities to minimize risk to public health or the environment. Additionally, the No Action alternative does not include monitoring the contaminant plume in groundwater.

Evaluation

The “No Action” alternative does not meet the OU14 RAOs. It would allow for natural attenuation to continue to reduce COC concentrations in the contaminant plumes, but the lack of active cleanup, controls, or monitoring could potentially cause exposure to COCs in the future. In particular, compliance with RAOs cannot be met and site closure cannot occur without monitoring.

5.2.2 Alternative 2—Land-Use Controls

Description

LUCs have been evaluated in this FS both as a stand-alone alternative and in conjunction with Alternatives 3 (MNA), 4 (Biosparge), and 5 (ERD). The same objectives, implementation, and maintenance activities associated with the LUCs essentially pertain to each alternative (with the exception of the No Action alternative) because LUCs will be required until cleanup levels are met. The purpose of the LUCs are to limit direct contact to contaminated groundwater with COC concentrations above cleanup levels and to limit the potential for vapor intrusion issues from COCs in groundwater (due to potential future building construction activities).LUCs would be implemented at OU14 to: (1) prevent human contact with groundwater contaminated with COC concentrations above cleanup levels and (2) minimize the potential for future vapor intrusion issues from COCs in groundwater underlying newly-constructed or modified buildings at OU14. The LUCS to be implemented include, but are not limited to, land use restrictions in the Base Master Plan process and the filing of a Notice of Contaminated Site per North Carolina General Statutes 143B-279.9 and 143B-279.10. The LUCs will be implemented and maintained by the Navy and MCAS Cherry Point until the concentrations of hazardous substances in the groundwater are at such levels to allow for unrestricted use and unlimited exposure. The specific objectives of the LUCs include the following:

- Prohibit all uses of groundwater from the Surficial Aquifer in areas where COC concentrations exceed cleanup levels, including but not limited to, human consumption, dewatering, irrigation, heating/cooling and industrial processes, unless prior written approval is obtained from the Navy, MCAS Cherry Point, EPA and NCDENR. These areas are defined by the limits of AA1 and AA2 (Figure 3-1).
- Prohibit unauthorized intrusive activities below the water table in areas with contaminated groundwater. These areas are defined by the limits of AA1 and AA2 (Figure 3-1).
- Limit activities that would interfere with operation of the selected remedy or cause uncontrolled exposures to COCs.
- Evaluate vapor intrusion issues, if necessary, prior to construction of new buildings or in the event of a major building modification at OU14 until groundwater cleanup levels are met (potential vapor issues also will be indirectly addressed by the selected groundwater alternative).
- Maintain the integrity of any existing or future monitoring or remediation system at the site.

Evaluation

Successful implementation of LUCs, including adequate documentation and communication, would be required for the protection of human health and the environment. For this FS, the following supplemental implementation measures are proposed where applicable:

- Incorporate groundwater use restrictions into the ROD for OU14.

- Define LUCS in the RD or prepare a separate LUC RD that will provide: (1) a record document of the areal extent of groundwater restrictions and restrictions based on potential vapor issues from future building construction activities, and (2) provide implementation and maintenance instructions.
- Incorporate the LUC boundaries into the Air Station's master planning process and GIS.
- Communicate pre-construction vapor intrusion evaluation requirements to base planners.

The following maintenance measures are proposed for successful implementation of LUCs:

- Update the LUC Assurance Plan to incorporate OU14 LUCs.
- Incorporate pre-construction vapor intrusion evaluation into the building and construction approval processes.
- Conduct quarterly site inspections to ensure that groundwater use restrictions are maintained.
- Review the integrity and effectiveness of the LUCs during the 5-Year Reviews.

As a stand-alone alternative, LUCs cannot meet RAOs due to the lack of monitoring to gauge compliance with cleanup levels. However, LUCs are an essential component of each of Alternatives 3, 4, and 5 to enable them to meet RAOs. Cost assumptions and details for Alternative 2 are provided in Appendix C. LUC assumptions specific to each of Alternatives 3 (MNA), 4 (Biosparge), and 5 (ERD) are described below.

5.2.3 Alternative 3—MNA and LUCs

Description

MNA is included in this alternative as a stand-alone remedial action, but is also a component of Alternatives 4 (Biosparge) and 5 (ERD). Natural attenuation is the remediation process for this remedy, and MNA is simply the implementation of that remedy in conjunction with groundwater performance monitoring (e.g., monitoring the decrease of COC concentrations over time).

The eight USEPA (1999a and 2004) objectives for performance monitoring of an MNA remedy are as follows:

1. Demonstrate that natural attenuation is occurring according to expectations.
2. Detect changes in environmental conditions (e.g., hydrogeologic, geochemical, microbiological, or other changes) that may reduce the efficacy of any of the natural attenuation processes.
3. Identify any potentially toxic and/or mobile transformation products.
4. Verify that the plume(s) is(are) not expanding downgradient, laterally or vertically.
5. Verify no unacceptable impact to downgradient receptors.
6. Detect new releases of contaminants to the environment that could impact the effectiveness of the natural attenuation remedy.

7. Demonstrate the efficacy of institutional controls put in place to protect potential receptors.
8. Verify attainment of remediation objectives.

MNA is being considered more frequently as part of remedial actions at various CERCLA sites. USEPA does not consider MNA to be a "presumptive" or "default" remedy—it is one option that should be evaluated with other applicable remedies (USEPA, 1999a). EPA does not view MNA to be a "no action" or "walk-away" approach, but rather considers it to be an alternative means of achieving remediation objectives that may be appropriate for specific, well-documented site circumstances where its use meets the applicable statutory and regulatory requirements.

MNA is considered and evaluated within this FS as a remedy in itself, and also as a viable component of one or more remedial alternatives. Source control and long-term performance monitoring are fundamental components of any MNA remedy (USEPA, 1999a). The use of MNA differs from the No Action alternative because performance monitoring continues until the RAOs have been achieved, and longer if necessary to verify that the site no longer poses a threat to human health and/or the environment.

Natural attenuation is the name given to the combination of natural processes occurring at a site that result in a decrease in concentration of a COC with time or distance from a source. Natural attenuation mechanisms can be classified as either destructive or nondestructive. Destructive mechanisms actually remove the parent compound from the environment by breaking it down into one or more simpler compounds. Nondestructive mechanisms generally transfer the parent compound from one environmental medium into another, or spread the parent compound over a greater volume of the same environmental medium. The most common destructive natural attenuation mechanism is biodegradation. Nondestructive mechanisms include dilution, dispersion, advection, sorption, and volatilization.

While anaerobic biodegradation of highly chlorinated aliphatic compounds generally proceeds readily in strong reducing, anaerobic environments, aerobic degradation of these compounds is less likely (USEPA, 1999b). UST Program AS remediation systems at OU14 inject ambient air into the Surficial Aquifer at certain locations to strip dissolved-phase POL compounds. This resupplies the aquifer with oxygen and maintains aerobic conditions in the vicinity of the system. The degree of chlorination of the aliphatic compound will determine its ability to be aerobically biodegraded. Compounds such as tetrachloroethene (PCE), which is highly oxidized and highly chlorinated, will not be readily biodegraded under aerobic conditions, whereas less-oxidized and less highly-chlorinated compounds such as vinyl chloride will aerobically biodegrade. The major route of degradation for these less-chlorinated compounds is via a cometabolic pathway using broad specificity bacterial oxygenases. In this case, the chlorinated aliphatic is not used as a growth substrate but is fortuitously degraded during the biodegradation of other non-chlorinated compounds (or methane) present in the bacterial environment. Methanotrophs (methane-oxidizing bacteria) are able to metabolize some chlorinated aliphatics during a cometabolic process due to the methane monooxygenase enzyme complex. However, the rate of aerobic degradation by methanotrophs also appears to lessen with an increasing number of chlorine atoms on the molecule (Broholm et. al., 1991; Henson et. al., 1988). PCE and TCE are apparently not

susceptible to degradation by methanotrophs (Broholm et. al., 1991; Henson et. al., 1988; Lige et. al., 1995).

Evaluation

The benefits of MNA include the following:

- Generation of a lesser volume of remediation-derived wastes. No waste stream other than purge water generated during sampling events (or soil cuttings if additional monitoring wells are installed).
- Does not require the installation of infrastructure other than a network of monitoring points.
- Does not rely on the application of any amendments or natural attenuation enhancements to the subsurface.
- There is no operation and maintenance (O&M) associated with MNA other than monitoring well maintenance.

The disadvantages of MNA include the following:

- MNA has limited ability to remediate CVOC dense non-aqueous phase liquid (DNAPL) in groundwater (not applicable to OU14).
- MNA often takes a longer time to achieve cleanup levels versus other more aggressive remedies.
- MNA is limited by naturally existing physical, biological, and geochemical processes. Native geochemical and biological conditions may not be sufficient to completely reduce any remaining contaminant sources (not applicable to OU14). In such conditions, MNA relies solely on the slower physical processes of diffusion and dispersion.

Although MNA performance monitoring has not started at OU14 (an MNA remedy has not been implemented), the eight USEPA MNA performance monitoring objectives have already been partially met based on data and conclusions presented in the OU14 RI Report (CH2M HILL, 2008) as detailed in Table 5-1. The OU14 RI concluded that the CVOC plumes throughout OU14 have stabilized due to natural attenuation processes (Sections 2.2.4 and 2.2.5). There is no indication of the presence of continuing CVOC sources. The concentrations of the COCs in groundwater attenuate to concentrations below NC2B surface water standards before the groundwater reaches and discharges into the unnamed stream (Figure 2-8 and Appendixes A and G). The breakdown / transformation products of highly-chlorinated CVOCs are included as COCs in this FS. Surface water and sediment data from the stream indicate no unacceptable human health or ecological risk and no ARAR non-compliance (Figure 2-13 and Appendixes A and G). Discussions of natural attenuation efficacy at OU14 based on RI data are provided in Section 2.2.4 and 2.2.5. Additional data that would be collected during baseline sampling followed by performance monitoring would provide further evidence of the progress of MNA.

The presence of cis-1,2-DCE and VC, the daughter products of TCE degradation, along with the natural attenuation parameter results, suggest that natural attenuation processes have been degrading the CVOC contamination in both the Upper and Lower Surficial Aquifer.

The evaluation of natural attenuation parameters discussed in Section 2.2.4 indicates conditions are generally favorable for natural attenuation at OU14. The POL compounds (e.g., benzene) from the plumes being addressed by the UST Program commingled with the CVOCs throughout OU14 (Figures 2-9 and 2-10) have likely facilitated the significant biodegradation of the CVOCs and will continue to provide carbon to the indigenous microorganisms in the aquifer that degrade the CVOCs. UST Program AS and SVE remedial systems at OU14 (see Appendix A) likely have some impact to expedite the removal of CVOCs by stripping and enhancing aerobic biodegradation conditions within the zone of influence of each system.

The aquifer was not tested for dechlorinating bacteria; however, these indigenous microorganisms are generally present through the East Coast and have been found at other Navy ERP Sites in the North Carolina Coastal Plain (e.g., Camp Lejeune Site 73; Baker, 2002). Groundwater samples would be collected and analyzed for dechlorinating bacteria during baseline sampling. There are some plume areas that may be carbon-limited based on historical TOC data, which could potentially cause a stall in anaerobic reductive dechlorination (but allow for aerobic cometabolic biodegradation); however, the RI TOC data was limited spatially—more data would be collected during the baseline sampling.

The time required to meet cleanup levels for the MNA alternative is conservatively estimated to be greater than 100 years. However, additional data collected during baseline sampling and subsequent performance monitoring would provide additional site-specific information concerning the progress of MNA. A more robust temporal dataset would also provide additional site-specific information (e.g., allow COC decay rates to be determined) to better estimate a timeframe for natural attenuation. With a larger temporal data set, the MNA alternative could be reevaluated by the Team after a 3- to 5-year period to determine if an active remedial technology would be appropriate to reduce the expected timeframe for remediation.

The 100-year conservative time estimate does not account for several factors at OU14 that might facilitate the attenuation of COCs and decrease the time required for cleanup levels to be met. For example, the limited extent of existing UST Program AS and SVE remedial systems at OU14 (see Appendix A) likely have some impact to expedite the removal and degradation of CVOCs by stripping and enhancing aerobic biodegradation conditions. While the oxygen introduced into the aquifer by the AS systems will impede natural anaerobic biodegradation in the immediate vicinity of the AS systems, the DO will be exhausted in these areas by aerobic degradation of dissolved-phase POL compounds. The aquifer will return to anaerobic conditions downgradient as the ORP in the aquifer decreases. The UST Program continues to evaluate the potential need for new systems and the expansion of existing systems. In addition, the presence of POL compounds commingled with CVOCs provides a potential carbon source that could facilitate the natural anaerobic biodegradation of CVOCs at OU14.

Additional elements of Alternative 3:

- Implementation, O&M, monitoring, reporting, and other cost assumptions are provided in Appendix C.

- LUCs would need to be maintained until RAOs are achieved (See Alternative 2 description in Section 5.2.2 for LUC details).
- Potential indoor air vapor issues (risk to future residents or workers) will be indirectly addressed by the MNA component of Alternative 3.
- The remedy would be reviewed for protectiveness during each subsequent 5-year review (Section 5.1.4).

The greatest uncertainty for this alternative is the estimated timeframe to meet cleanup levels. Baseline and performance sampling would provide the temporal COC and geochemical data needed to make a more accurate estimation. The timeframe to meet cleanup levels is also a significant uncertainty for Alternatives 4 and 5.

5.2.4 Alternative 4—Biosparging, MNA, and LUCs

Description

AS and biosparging are in situ technologies involving the injection of air into the aquifer or water-bearing zone at a depth of at least 10 to 30 feet below the water table. Sparged air can be delivered via a network of vertical wells or horizontal directionally drilled (HDD) wells connected to a blower or air compressor. Sparged air rises through the saturated zone in a complex and non-uniform series of finger-like channels, the paths of which are strongly influenced by subsurface heterogeneity. AS and biosparging can be used to induce mass transfer (stripping, or volatilization) of VOCs from groundwater and enhance aerobic biological degradation. Biosparging utilizes a lower airflow injection rate than AS.

Traditional AS systems are often installed in conjunction with simultaneous SVE to prevent excessive fugitive vapor migration. The UST Program currently operates limited SVE systems at OU14 to address petroleum contamination. However, experience at MCAS Cherry Point and at OU14 has shown that SVE would be difficult to implement at OU14 because of the elevated water table (shallow vadose zone) combined with the relatively low permeability vadose zone soils. For example, earlier AS/SVE operations at adjacent OU1 experienced chronic flooding of the SVE wells that greatly limited the system effectiveness. In contrast to traditional AS systems, biosparge systems are designed to operate at lower airflow rates, minimizing off-gas production, and generally eliminating the need for SVE (as well as vapor treatment). For these reasons, biosparging has been carried forward as the preferred sparging option in this FS.

Evaluation

Sparging has been shown to be effective at OU14 for removal of volatile POL compounds from the Surficial Aquifer. Similarly, low-level CVOCs, if present in the vicinity of a sparge system, are volatilized from the groundwater and potentially can be aerobically biodegraded at the same time as petroleum compounds by UST Program AS systems currently in operation at OU14. Sparging inherently will increase the risk of vapor intrusion issues in buildings near the areas of injection or via utility conduits to buildings near the areas of injection. As previously discussed, SVE was not considered in the evaluation for this alternative; however, a limited number of shallow SVE wells could be installed adjacent to specific buildings as a contingency measure, if deemed necessary during system design

activities. Alternatively, passive or active vapor mitigation systems could be implemented depending on building occupancy if deemed necessary during system design and/or system startup activities.

Benefits of biosparging include the following:

- This technology can be implemented with standard well constructions and typically does not require specialized tools for installation or operation.
- No amendments are introduced into the subsurface, other than ambient air. The aboveground equipment is relatively inexpensive to purchase and operate. "Pulsed" operation is often used to reduce energy costs.
- Continuously operating systems (including pulsed operation) generally achieve cleanup goals faster, with decreased potential for contaminant concentration "rebound."
- Health and safety concerns, aside from proper management of compressed air above ground, are minimal.
- Gaseous reagents (in this case, air) can more effectively penetrate fine grained porous media than liquid reagents (e.g., liquid substrate injected for ERD as described in Alternative 5).
- No waste stream is generated for offsite disposal, other than recyclable activated carbon if SVE is used in the process to capture and treat the vapor stream (if necessary). The UST Program currently has multiple AS systems and some SVE systems in operation at OU14.

Disadvantages of biosparging include the following:

- Applicability is typically limited to homogeneous, moderate- to high-permeability aquifers (i.e. greater than 10^{-4} centimeter per second [cm/s] hydraulic conductivity). The technology is less effective within heterogeneous, low-permeability environments. The Surficial Aquifer beneath OU14 is somewhat heterogeneous, but a relatively high-permeability aquifer.
- Subsurface air injection, even under low-flow conditions, likely increases the risk of indoor air vapor intrusion issues (from CVOCs, dissolved-phase POL constituents, and POL FP). Significant vapor production is generally limited to the first several months of operation, after which time biodegradation dominates. Pulsed biosparge operation is one method to decrease the potential for significant intrusion of vapors. The UST Program currently has multiple AS systems and some SVE systems in operation at OU14, and monitors vapors in utility vaults and some small structures.
- Temporary groundwater mounding occurs during and immediately after system startup. This mounding would temporarily affect groundwater flow and POL FP movement, which might be disruptive to FP extraction systems currently in place at OU14. However, these issues would be monitored closely to manage any significant changes with system adjustments.
- The introduction of ambient air into an aquifer can result in high subsurface oxygen conditions. These conditions can be counterproductive to naturally occurring or artificially

enhanced anaerobic biodegradation processes that require a reducing environment in the aquifer.

The following assumptions were made concerning a biosparge system for this detailed technical evaluation and in order to estimate system costs:

- Because of the dense network of buried utilities at the site and limited access for drilling, HDD wells are considered the preferred biosparge methodology.
- HDD biosparge wells are typically installed along the axis of the plume, in order to contact impacted groundwater as efficiently as possible.
- A single header/manifold would connect the horizontal well to aboveground process equipment, consisting primarily of a rotary screw air compressor and small enclosure.
- Each HDD well would be "continuous" (double-ended) design, whereby the pilot bore is drilled using mud rotary methods, the boring is back-reamed, and the casing is pulled back through the boring.
- A portion of the well casing would be slotted, allowing air to be injected. The HDD biosparge wells would be constructed of 4-inch diameter, DR 11 high density polyethylene (HDPE), and/or stainless steel. Each well includes three primary sections: 1) the entry, or proximal section; 2) the slotted section; and 3) the exit, or distal end/section. The proximal section (closest to the drill rig) is typically advanced at a slope of approximately 20 percent, and the distal section is similar, or slightly steeper. The central slotted section is drilled as flat as possible to ensure relatively uniform distribution of air. Slot design would be numerically modeled in advance of the drilling process (the slot configuration typically ranges from 0.1 to 0.3% for long screen applications). When completed, the well resembles a long, shallow "U," with a radius of curvature at either end of the slotted section.
- The target depth for slotted portion of wells at OU14 would range from 40 to 50 ft bgs, depending on the location at the site (approximately 30 feet below the static water table).

Figure 5-1 presents the HDD biosparge conceptual layout for Alternative 4. The layout focuses the biosparge influence within the most highly-impacted areas with consideration of plume extent, groundwater and COC travel times, and reasonable cost of the implementation and O&M. The configuration consists of approximately 1,630 linear ft of HDD biosparge well screen: One 430-ft HDD biosparge well screen installed perpendicular to groundwater flow at the Building 130 Wash Rack area, two HDD biosparge well screens installed along the plume axis between Building 130 and Building 250 (one measuring 500-ft and one measuring 200-ft long), and one 500-ft HDD biosparge well screen installed along the plume access focusing on the area downgradient of Building 4075 (where TCE was detected at 180 µg/L during the RI). Proximal header and distal sections, conveyance piping, electrical conduits, manifolds, and the multiple blow package assumptions are provided in the cost estimate in Appendix C.

The installation (trenching) of the associated conveyance piping and electrical conduits may prove difficult at OU14 considering ongoing military and other site operations and the extensive utility density (Figure 2-2).

The estimated time to reach cleanup levels is at least 40 years (depending on system performance) assuming pulsed sparging of focused target zones in conjunction with ongoing MNA for other areas and follow-on MNA in treatment areas. The POL contamination at the site within the areas of impact for this system would also be treated by this technology, but would limit the efficiency of CVOC removal.

Implementation, O&M, monitoring, reporting, and other alternative cost assumptions are provided in Appendix C. Other general assumptions include the following:

- LUCs would need to be maintained until RAOs are achieved (See Alternative 2 description in Section 5.2.2 for LUC details).
- MNA is a significant component of this alternative, and monitoring data would be evaluated to determine system performance and site progress toward meeting cleanup levels.
- The remedy also would be reviewed for protectiveness during each 5-year review (Section 5.1.4).

The uncertainties for this alternative include the following:

- The estimated timeframe to meet cleanup levels.
- The extent of lateral distribution of air within the aquifer, and site logistics (particularly with regard to subsurface utilities and ongoing site operations). Baseline and performance sampling would provide the supplemental data needed to refine time estimates, as well as optimize operational efficiency (same as Alternatives 3 and 5). The UST Program has some AS systems in operation that could potentially be utilized for or in combination with this alternative.
- The distance of influence that can be achieved by individual vertical biosparge wells is unknown, but generally ranges from 8 to 15 ft. A distance of influence of greater than 50 ft has been achieved using HDD wells at Marine Corps Base Camp Lejeune, NC, in conditions similar to OU14. Additional field testing would be required to determine the necessary sparge well density.
- The impacts or enhanced mobilization on existing COC vapor plumes and the potential impacts on indoor air intrusion are unknown, especially considering the extensive utility networks at OU14 (Figure 2-2).
- Locations to stage the operational equipment and exact utility hookups (to be determined during RD phase) would need to be carefully selected, to avoid interference with Base operations.

Baseline and performance sampling would provide the supplemental data needed to refine the remediation time estimate as well as to optimize operational efficiency (same as Alternatives 3 and 5).

5.2.5 Alternative 5—Enhanced Reductive Dechlorination (ERD), MNA, and LUCs

Description

ERD promotes the natural degradation of chlorinated solvents by indigenous anaerobic microorganisms in the aquifer through the addition of carbon sources (electron donor substrates). The organic substrate is fermented to hydrogen and low molecular weight organic acids (i.e., electron donors) to support anaerobic reductive dechlorination as the primary process for degrading chlorinated solvents in groundwater (AFCEE, 2007).

During reductive dechlorination a carbon atom accepts an electron from an electron donor (reduction), causing the release of a chlorine atom (dechlorination). The more chlorine atoms a compound has, the more oxidized its carbon is, and therefore, the more susceptible it is to reductive dechlorination. This process results in sequential dechlorination of a contaminant. The general, reductive dechlorination process results in the formation of degradation ("daughter") products, in the following order (for reductive dechlorination of TCE):

TCE → cis-1,2-DCE → VC → ethene

The transformation rates for each step vary but tend to become slower with progress along the breakdown sequence, which can result in accumulation of cis-1,2-DCE and vinyl chloride. Further breakdown from cis-1,2-DCE and vinyl chloride to ethene varies and is based on site-specific conditions.

In most natural systems, organic electron donors are in short supply. By adding such donors, natural anaerobic biodegradation via reductive dechlorination is enhanced. A variety of different organic electron donor substrates have been used to stimulate reductive dechlorination. The substrates can be broadly categorized into four types (AFCEE, 2007): soluble substrates (e.g., sodium lactate and molasses), slow-release substrates (e.g., food-grade vegetable oil), solid substrates (e.g., mulch) and miscellaneous experimental substrates (e.g., hydrogen gas).

Substrate Delivery Method. Electron donor substrates are typically introduced to the aquifer via trenching and filling to create a biomulch wall, placing in excavations or mixing with the soil or backfill, and injection points. Soluble and slow-release substrates are often injected in a grid pattern in a source area, or in a linear 'biowall' configuration perpendicular to groundwater flow in a dissolved-phase plume. Biomulch walls are also typically installed perpendicular to groundwater flow in a dissolved-phase plume.

Utilities and site operations at OU14 preclude trenching applications (Table 4-2b). Therefore, the injection point methodology has been carried forward as the preferred ERD option in this FS. Permanent injection points (constructed injection wells or open borehole injection wells) or temporary injection points (using DPT-type equipment) may be utilized for substrate delivery. Permanent injection points are generally preferable if multiple injections will be required at a site. Depending on the geology and injection method, pneumatic fracturing (PF) or hydraulic fracturing (HF) patented techniques can enhance the distribution of the injected material and maximize contact of the material with the COCs. These techniques can only be performed using DPT methodology or within open borehole injection wells. The native materials at OU14 (relatively clean sands) make PF and HF

unnecessary for effective distribution of the injected substrate. Further, this alternative assumes multiple substrate injections would be required to treat the extensive dissolved phase CVOC plumes, making temporary injection points less cost-effective. Therefore, the injection process considered in this alternative utilizes to-be-installed permanent injection wells.

Bioaugmentation. Insufficient or inappropriate indigenous microbial population can prevent the complete biodegradation of CVOCs. Bioaugmentation is a process that can be performed in conjunction with ERD, and involves introducing specially adapted microbial cultures that are able to readily degrade CVOCs. The complete dechlorination of chlorinated ethenes requires a number of different groups of anaerobic bacteria including acetogens (acetate producers), sulphate reducers, and halo-respirers (specific anaerobic microorganisms that mediate certain dechlorination reactions) (ESTCP, 2006). Sulphate reducers, and possibly methanogens, appear to be able to mediate the initial steps of dechlorination of PCE and TCE to cis-1,2-DCE, and specific halo-respiring microorganisms appear to be required to mediate further and complete dechlorination of cis-1,2-DCE to VC and ethene. To date, a number of distinct types of halorespiring bacteria have been identified, including *Dehalospirillium multivorans* (Scholz- Muramatsu et al., 1995), *Dehalobacter restrictus* (Schumacher and Holliger, 1996) and *Dehalococcoides ethenogenes* (Maymo-Gatell et al., 1997). These halo-respiring microorganisms do not appear to be ubiquitous at all sites. Alternatively, these microorganisms are present but are not active. As a result, dechlorination of PCE and TCE can stall at cis-1,2-DCE at many sites.

However, it is expected that indigenous dehalogenating bacteria are present at OU14 based on the detections of PCE and TCE daughter products in groundwater. Through enhancement of conditions using adequate electron donors during the implementation of ERD, the bacterial biomass would be expected to increase and, in turn, anaerobic biodegradation rates would increase. The aquifer would be tested for these bacteria during baseline sampling and performance monitoring. It was assumed in this FS that bioaugmentation would not be necessary for successful implementation of ERD at OU14.

Evaluation

For large plumes, it is not economically feasible to remediate the entire plume at one time due to the relatively high cost of installing the required number of injection wells. A more cost-effective approach is to install biowalls (i.e., injection well biowalls for this Alternative) at several different transects perpendicular to groundwater flow along the axis of the plume (AFCEE, 2007). Based on the areal extent of the CVOC plumes at OU14 and lack of continuing CVOC source areas, the biowall injection well configuration was considered to be the most appropriate and cost-effective approach to implement ERD at OU14.

Biowalls generally should extend across the width of the contaminant plume (or portion of the plume) that requires remediation to allow for uncertainties in the actual plume dimensions, variations in groundwater flow directions, and to allow for some permeability loss. Groundwater residence time within the biowall reaction zone is typically controlled by the groundwater flow velocity and biowall thickness along the direction of groundwater flow. The biowall spacing along the plume axis and substrate injection frequency take into account the rate of groundwater flow, substrate longevity, and the travel time between the biowalls (AFCEE, 2007).

The appropriate type of electron donor substrate for a given site involves the ability to effectively distribute the substrate throughout the treatment zone and the ability to sustain the reactive zone with that substrate over the treatment timeframe in a cost-effective manner (AFCEE, 2007). In general, the more soluble the substrate the easier it is to mix and distribute throughout the aquifer matrix. However, many soluble substrates (e.g., lactate) are too readily biodegradable (i.e., consumed too quickly) and the need for frequent reinjections reduces cost-effectiveness.

The longevity of an organic substrate in the subsurface can be manipulated by choosing substrates based upon viscosity, chemical structure, solubility, or physical structure (AFCEE, 2007). Emulsified vegetable oils are frequently used for ERD applications due to their ease of injection and distribution (the emulsions are miscible during injection) in conjunction with their lower solubility and viscosity. When the emulsion is properly prepared and injected, the vegetable oil would remain in place due to sorption or entrapment within the aquifer matrix. Due to its low solubility, the vegetable oil has greater longevity. Substrate mixtures of emulsified oils and more soluble, faster-acting electron donors (e.g., lactate) are commonly used for ERD. Additional mixture ingredients can include micronutrients such as amino acids, yeast, and vitamin B12, which have been found to accelerate the biodegradation of the CVOCs (EOS Remediation, 2008).

CVOCs will also partition into the vegetable oil, substantially reducing aqueous phase concentrations and/or contaminant mobility (AFCEE, 2007 and EOS® Remediation, 2008). In this process, known as sequestration, the vegetable oil essentially acts as a "sponge" to quickly reduce concentrations of CVOCs in groundwater. As the CVOCs in the aqueous phase are degraded, additional CVOC mass is released from the vegetable oil due to equilibrium partitioning. Over time, continued degradation of CVOCs in the aqueous phase will lower the amount of CVOC mass residing in the vegetable oil-phase. In addition, the CVOC mass in the vegetable oil-phase will be reduced as the mass of vegetable oil is degraded. Therefore, sequestration of CVOCs due to partitioning is a ultimately a temporal phenomena if biodegradation of solvents in groundwater can be stimulated and sustained.

For cost-estimating purposes, the EOS® brand emulsified oil product was assumed in this evaluation based on its ERD success rates in both bench test studies and numerous field applications for the Navy. EOS® is a mixture of soybean oil and sodium lactate (micronutrients are optional additives). The lactate is consumed quickly due to its effect on microbial growth rate (increased biomass growth), resulting in a brief period of relatively high levels of hydrogen. The soybean oil degrades slower, providing a source of electron donor for an extended period of time. Other emulsified oil products similar to the EOS® brand are available (e.g., SRS™ and Newmans Zone®).

Appendix C provides the EOS® dosage assumptions based on EOS® Remediation's (2008) empirical *aquifer sorption capacity* values, which range from 0.001 to 0.002 lb EOS® / lb soil for fine sands with some clay, to 0.002 to 0.004 for sand with higher silt/clay content. Based on the site-specific geology at OU14 (Section 2.2.2), the sorption capacity value of 0.002 was assumed to determine dosages and costs for this alternative. The determination of final design parameters would be made during the RD phase.

A pH close to neutral (i.e., 6.0 to 8.0) is the most conducive to the proliferation of healthy, diverse microbial populations. Aquifer pH buffering (via injection of sodium bicarbonate

with the electron donor substrate or periodically between injections) would be required to maintain optimal conditions for ERD, and pH would need to be monitored throughout the remedy. RI data show 2005/2008 pH conditions between 4 and 6 and some between 6 and 7 throughout the aquifer. Low groundwater flow rates may result in a build up of organic acids during ERD that cause a pH drop due to the inability to disperse the acids. A pH drop below 6 may result in incomplete dechlorination (e.g., DCE stall) despite the presence of the appropriate dechlorinating microorganisms. Therefore, it was assumed that aquifer buffering would be necessary for successful implementation of ERD at OU14.

A primary limitation of site-wide cleanup using ERD biowalls is the desorption of CVOCs from the aquifer matrix and the diffusion of CVOCs out of low-permeability sediments outside of the treatment zones (AFCEE, 2007). Therefore, several pore volumes of groundwater must pass through successive biowalls before groundwater concentrations approach cleanup levels. An emulsified oil biowall typically remains effective for 3 to 4 years, depending on contaminant concentrations and other geochemical conditions, after each substrate injection. Biowalls ideally would be installed throughout the plume no further apart than the distance groundwater travels in 1 to 2 years. Given the average rate of groundwater flow at OU14 (28 feet/year), the plume length at OU14 greater than 4,000 feet, and the areal extent of the CVOC plume greater than 50 acres, the number of ERD injection wells and biowalls that would be required to achieve the fastest possible cleanup would not be technically feasible or cost-justifiable. Therefore, the conceptual approach for ERD biowall placement evaluated for this alternative focuses on the plume areas with the highest CVOC concentrations (Figure 5-2). It is assumed that MNA would be employed in conjunction with ERD to ultimately reach cleanup goals. Implementation, O&M, monitoring, reporting, and other alternative cost assumptions are provided in Appendix C.

Based on the site geology and ERD applications at similar sites, no pilot tests would be proposed to confirm the radius of injection (ROI) of the emulsified oil mixture. The estimated effective ROI of the emulsified oil mixture at OU14 would be 15 ft. Therefore, for cost estimating purposes, it has been assumed that permanent injection wells would be installed on 25 ft centers along each biowall line to provide an estimated 5 ft overlap of substrate during each injection. The wells would be constructed using 4-inch inner diameter ASTM Schedule 40 PVC screen and riser. The injection well screens were assumed to be 20-ft length, 0.020-inch slot PVC, continuous-wrap, and screened at the target intervals in either the Upper or Lower Surficial Aquifer, or both, depending on the location of the biowall. The typical injection depth interval was assumed to be 15 to 35 ft bgs and 30 to 50 ft bgs for the Upper and Lower Surficial Aquifers, respectively. The determination of final design parameters would be made during the RD phase.

Figure 5-2 presents the assumed ERD injection well biowall conceptual layout for Alternative 5. The layout focuses treatment within the areas with the highest concentrations, and also takes into consideration the plume extent, groundwater and COC travel times, and a reasonable cost for implementation and O&M. The configuration consists of six ERD injection well biowalls perpendicular to groundwater flow and one biowall installed in the direction of groundwater flow within the hotspot located at Building 4075, totaling 58 injection well 'locations' (shallow/deep pair locations and shallow only locations).

The installation of the numerous injection wells and associated performance monitoring wells would prove difficult at OU14 considering ongoing military and other site operations and the extensive utility density (Figure 2-2).

The timeframe to meet cleanup levels with this configuration is estimated to be at least 60 years. The existing UST Program AS and SVE remedial systems at OU14 (see Appendix A) would likely impede the enhancement of anaerobic conditions in portions of the site due the injection of air (oxygen) into the aquifer. The UST Program continues to evaluate the potential need for new systems and the expansion of existing systems— future UST Program AS systems might impede ideal ERD conditions. However, the presence of POL compounds commingled with CVOCs provides an additional carbon source for the aquifer (in addition to the ERD substrate to be injected).

Implementation, O&M (including re-injections), monitoring, reporting, and other alternative cost assumptions and details are provided in Appendix C. Other general assumptions include the following:

- LUCs would need to be maintained until RAOs are achieved (See Alternative 2 description in Section 5.2.2 for LUC details).
- MNA is a significant component of this alternative, and monitoring data would need be evaluated to determine system performance and site progress toward meeting cleanup levels.
- The remedy also would be reviewed for protectiveness during each 5-year review (Section 5.1.4).

Uncertainties for this alternative include the following:

- The estimated timeframe to meet cleanup levels.
- The achievable ROI for the electron donor substrate.
- The required frequency of reinjections of the electron donor substrate.

Baseline and performance sampling would provide the temporal COC and geochemical data needed to make a more accurate estimation of remedial timeframe (same as Alternatives 3 and 4), and also provide more data to determine the effective distribution of the substrate and the rate of substrate consumption.

Table 5-1
USEPA Monitored Natural Attenuation Performance Monitoring Objectives
Operable Unit 14, Site 90 Feasibility Study
MCAS Cherry Point, North Carolina

MNA Objective (USEPA, 2004)	Evaluation for OU14
1 Demonstrate that natural attenuation is occurring according to expectations.	The OU14 RI concluded that the CVOC plumes throughout OU14 have stabilized due to natural attenuation processes (Section 2.2.4 and 2.2.5). Further spatial and temporal data will be collected and evaluated during baseline sampling and performance monitoring.
2 Detect changes in environmental conditions (e.g., hydrogeologic, geochemical, or microbiological) that may reduce the efficacy of any of the natural attenuation processes.	None detected during the OU14 RI. Additional spatial and temporal data will be collected during baseline sampling and performance monitoring.
3 Identify any potentially toxic and/or mobile transformation products.	CVOC breakdown products were identified and delineated during the RI (Figure 2-8 and Appendix A). Breakdown products of the COCs will be monitored along with the COCs (some of the COCs are breakdown products of PCE/TCE) during remedy implementation.
4 Verify that the plume(s) is not expanding downgradient, laterally or vertically.	The OU14 RI concluded that the CVOC plumes throughout OU14 have stabilized due to natural attenuation processes (Section 2.2.4 and 2.2.5). Further spatial and temporal data will be collected and evaluated during baseline sampling and performance monitoring.
5 Verify no unacceptable impact to downgradient receptors.	The OU14 RI concluded that the CVOC plumes throughout OU14 have stabilized due to natural attenuation processes (Section 2.2.4 and 2.2.5). The concentrations of CVOCs in groundwater have attenuated to concentrations below NC2L groundwater standards by the time groundwater has reached and discharges into the unnamed stream in the downgradient area of OU14.
6 Detect new releases of contaminants to the environment that could impact the effectiveness of the natural attenuation remedy.	There are no known continuing-CVOC-source areas at OU14.
7 Demonstrate the efficacy of institutional controls that were put in place to protect potential receptors.	LUCs will be implemented and enforced as they are at other current post-ROD sites at MCAS Cherry Point as part of remedy implementation.
8 Verify attainment of remediation objectives.	Attainment of RAOs will be evaluated throughout MNA. The remedy will be considered complete when the data show cleanup levels have been met within the AAs.

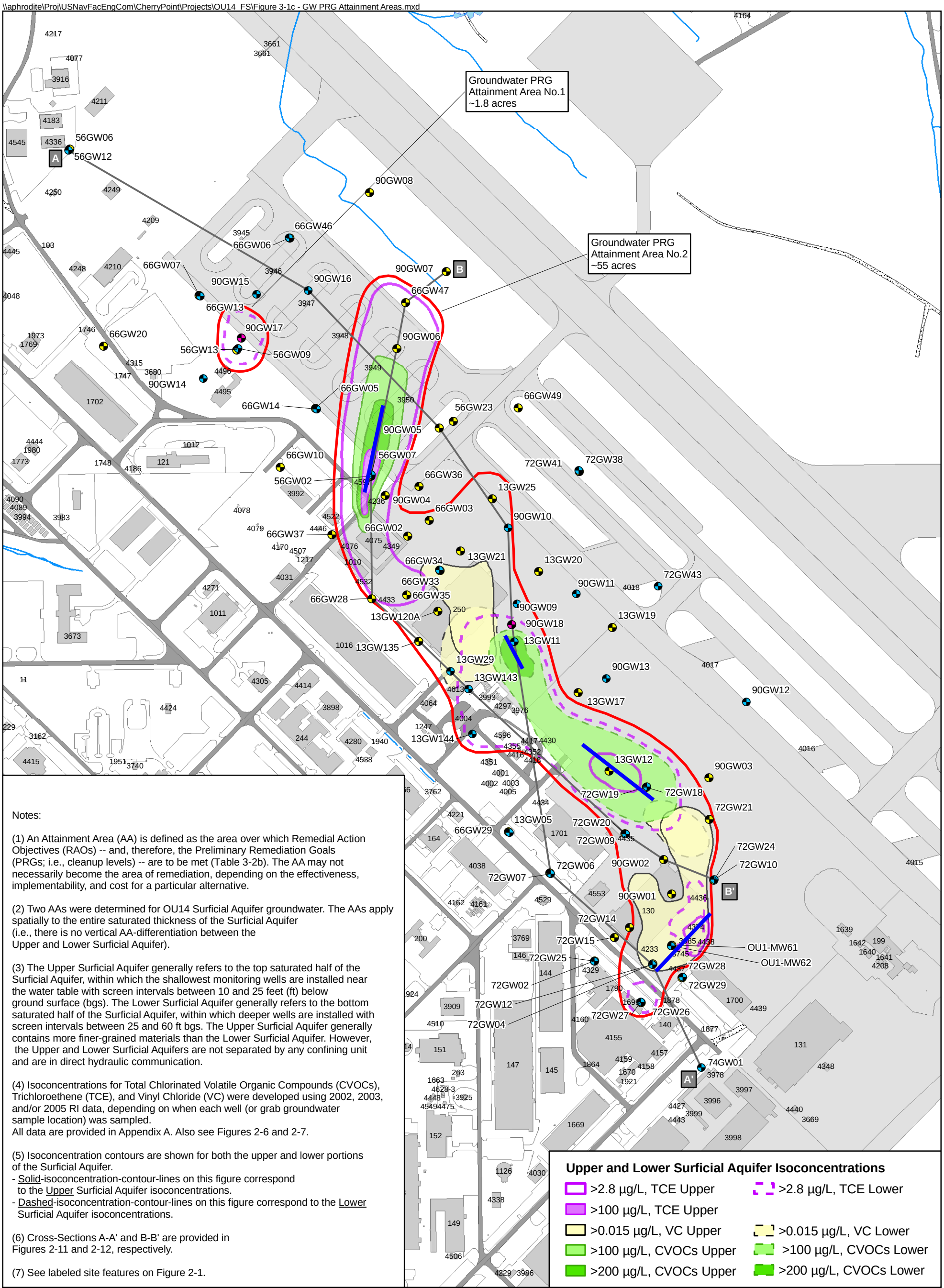
Notes:

The eight USEPA (1999a and 2004) objectives for performance monitoring of the Monitored Natural Attenuation (MNA) portion of Alternative 3 are discussed in Section 5.2.3.

USEPA. 1999a. *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites*. Office of Solid Waste and Emergency Response (OSWER) Directive 9200.4-17P. April 21.

USEPA. 2004. *Performance Monitoring of MNA Remedies for VOCs in Ground Water*. EPA/600/R-04/027. April.

\\aphrodite\Proj\USNavFacEngCom\CherryPoint\Projects\OU14_FS\Figure 3-1c - GW PRG Attainment Areas.mxd



Notes:

(1) An Attainment Area (AA) is defined as the area over which Remedial Action Objectives (RAOs) -- and, therefore, the Preliminary Remediation Goals (PRGs; i.e., cleanup levels) -- are to be met (Table 3-2b). The AA may not necessarily become the area of remediation, depending on the effectiveness, implementability, and cost for a particular alternative.

(2) Two AAs were determined for OU14 Surficial Aquifer groundwater. The AAs apply spatially to the entire saturated thickness of the Surficial Aquifer (i.e., there is no vertical AA-differentiation between the Upper and Lower Surficial Aquifer).

(3) The Upper Surficial Aquifer generally refers to the top saturated half of the Surficial Aquifer, within which the shallowest monitoring wells are installed near the water table with screen intervals between 10 and 25 feet (ft) below ground surface (bgs). The Lower Surficial Aquifer generally refers to the bottom saturated half of the Surficial Aquifer, within which deeper wells are installed with screen intervals between 25 and 60 ft bgs. The Upper Surficial Aquifer generally contains more finer-grained materials than the Lower Surficial Aquifer. However, the Upper and Lower Surficial Aquifers are not separated by any confining unit and are in direct hydraulic communication.

(4) Isoconcentrations for Total Chlorinated Volatile Organic Compounds (CVOCs), Trichloroethene (TCE), and Vinyl Chloride (VC) were developed using 2002, 2003, and/or 2005 RI data, depending on when each well (or grab groundwater sample location) was sampled.
All data are provided in Appendix A. Also see Figures 2-6 and 2-7.

(5) Isoconcentration contours are shown for both the upper and lower portions of the Surficial Aquifer.
- Solid-isoconcentration-contour-lines on this figure correspond to the Upper Surficial Aquifer isoconcentrations.
- Dashed-isoconcentration-contour-lines on this figure correspond to the Lower Surficial Aquifer isoconcentrations.

(6) Cross-Sections A-A' and B-B' are provided in Figures 2-11 and 2-12, respectively.

(7) See labeled site features on Figure 2-1.

Upper and Lower Surficial Aquifer Isoconcentrations

- >2.8 µg/L, TCE Upper
- >2.8 µg/L, TCE Lower
- >100 µg/L, TCE Upper
- >0.015 µg/L, VC Upper
- >0.015 µg/L, VC Lower
- >100 µg/L, CVOCs Upper
- >100 µg/L, CVOCs Lower
- >200 µg/L, CVOCs Upper
- >200 µg/L, CVOCs Lower

Legend

- Lower Surficial Aquifer Monitoring Well
- Yorktown Aquifer Monitoring Well
- Upper Surficial Aquifer Monitoring Well
- Transect for Cross-Section
- Groundwater PRG Attainment Area
- Surface Water

"Horizontal Directionally Drilled (HDD)" Biosparge Well linear configuration
- Greater than 50-ft radial distance of influence
- Associated connection piping and equipment staging not shown (may be incorporated into UST Program Remedial Systems)

N W E S

0 250 500 Feet

Figure 5-1
Alternative 4 - Biosparge
Conceptual Layout
Operable Unit 14, Site 90 Feasibility Study
MCAS Cherry Point
North Carolina

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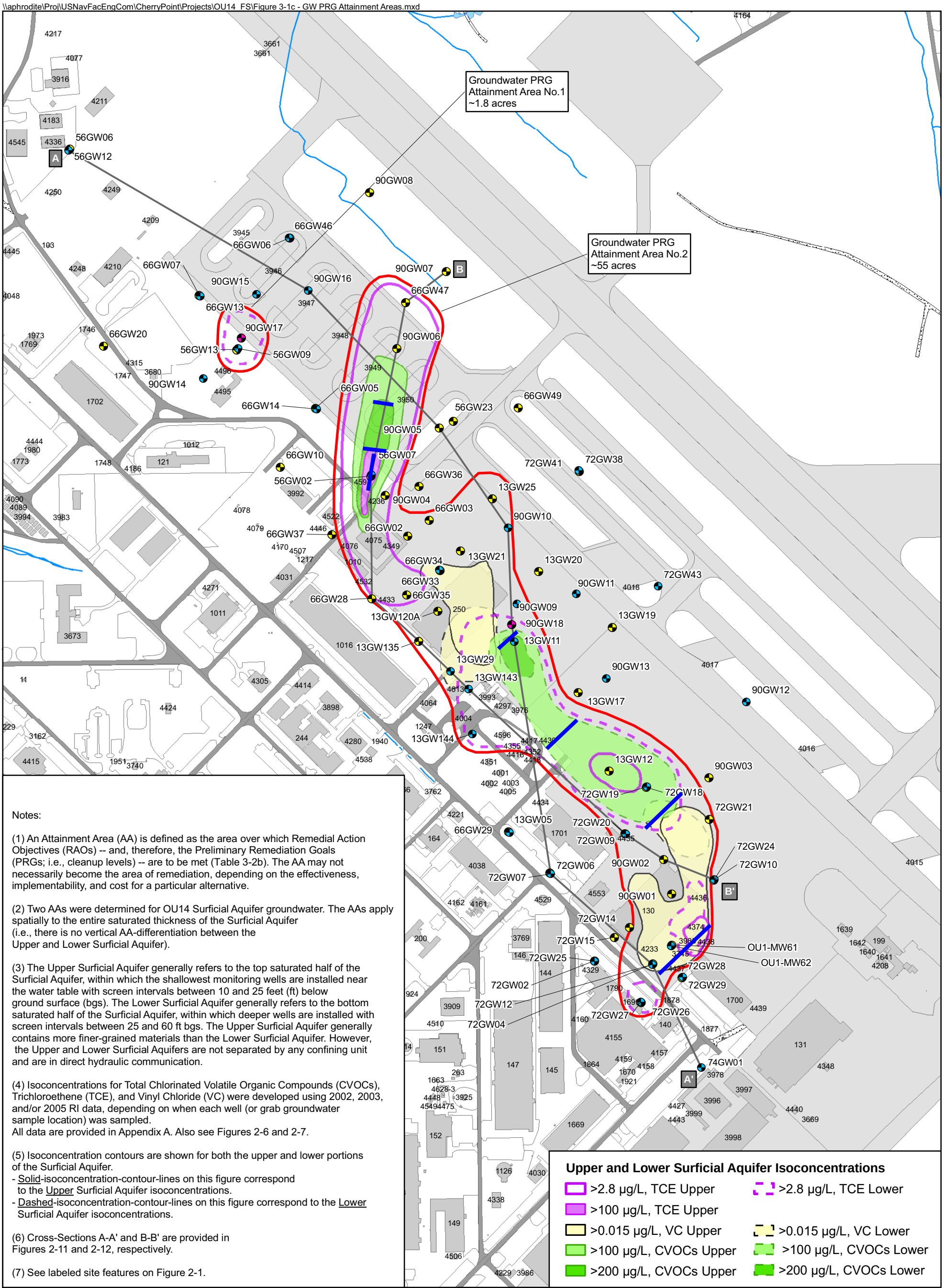
\\aphrodite\Proj\USNavFacEngCom\CherryPoint\Projects\OU14_FS\Figure 3-1c - GW PRG Attainment Areas.mxd



Notes:

(1) An Attainment Area (AA) is defined as the area over which Remedial Action Objectives (RAOs) -- and, therefore, the Preliminary Remediation Goals (PRGs; i.e., cleanup levels) -- are to be met (Table 3-2b). The AA may not necessarily become the area of remediation, depending on the effectiveness, implementability, and cost for a particular alternative.

(2) Two AAs were determined for OU14 Surficial Aquifer groundwater. The AAs apply spatially to the entire saturated thickness of the Surficial Aquifer (i.e., there is no vertical AA-differentiation between the Upper and Lower Surficial Aquifer).

(3) The Upper Surficial Aquifer generally refers to the top saturated half of the Surficial Aquifer, within which the shallowest monitoring wells are installed near the water table with screen intervals between 10 and 25 feet (ft) below ground surface (bgs). The Lower Surficial Aquifer generally refers to the bottom saturated half of the Surficial Aquifer, within which deeper wells are installed with screen intervals between 25 and 60 ft bgs. The Upper Surficial Aquifer generally contains more finer-grained materials than the Lower Surficial Aquifer. However, the Upper and Lower Surficial Aquifers are not separated by any confining unit and are in direct hydraulic communication.

(4) Isoconcentrations for Total Chlorinated Volatile Organic Compounds (CVOCs), Trichloroethene (TCE), and Vinyl Chloride (VC) were developed using 2002, 2003, and/or 2005 RI data, depending on when each well (or grab groundwater sample location) was sampled.
All data are provided in Appendix A. Also see Figures 2-6 and 2-7.

(5) Isoconcentration contours are shown for both the upper and lower portions of the Surficial Aquifer.
- Solid-isoconcentration-contour-lines on this figure correspond to the Upper Surficial Aquifer isoconcentrations.
- Dashed-isoconcentration-contour-lines on this figure correspond to the Lower Surficial Aquifer isoconcentrations.

(6) Cross-Sections A-A' and B-B' are provided in Figures 2-11 and 2-12, respectively.

(7) See labeled site features on Figure 2-1.

Upper and Lower Surficial Aquifer Isoconcentrations

- >2.8 µg/L, TCE Upper
- >2.8 µg/L, TCE Lower
- >100 µg/L, TCE Upper
- >0.015 µg/L, VC Upper
- >0.015 µg/L, VC Lower
- >100 µg/L, CVOCs Upper
- >100 µg/L, CVOCs Lower
- >200 µg/L, CVOCs Upper
- >200 µg/L, CVOCs Lower

Legend

- Lower Surficial Aquifer Monitoring Well
- Yorktown Aquifer Monitoring Well
- Upper Surficial Aquifer Monitoring Well
- Transect for Cross-Section
- Groundwater PRG Attainment Area
- Surface Water

Enhanced Reductive Dechlorination (ERD) Injection Well Biowall linear configuration
- 15-ft effective radius of injection
- 25-ft spacing-on-center injection locations
- Shallow/Deep injection well pairs throughout
- Shallow Injection wells only at Building 4075

N W E S

0 250 500 Feet

Figure 5-2
Alternative 5 - ERD Injection Well Biowall
Conceptual Layout
Operable Unit 14, Site 90 Feasibility Study
MCAS Cherry Point
North Carolina

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SECTION 6

Detailed and Comparative Analysis of Alternatives

In this section, detailed analysis is performed on the developed alternatives using the standard criteria specified in the *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA, 1988). The alternatives were evaluated individually against each criterion, and then the different alternatives were compared to determine specific strengths and weaknesses that must be balanced. The results of the detailed analysis support the selection of a remedial action and the foundation for the ROD.

The nine NCP evaluation criteria are as follows:

1. Overall protection of human health and the environment
2. Compliance with ARARs
3. Long-term effectiveness and permanence
4. Reduction of toxicity, mobility, or volume through treatment
5. Short-term effectiveness
6. Implementability
7. Cost
8. State acceptance
9. Community acceptance

The NCP [40 CFR Section 300.430(e)(9)(iii)] categorizes these nine criteria into the following three groups: (1) threshold criteria, (2) primary balancing criteria, and (3) modifying criteria. Each type of criteria has its own weight when it is evaluated.

- **Threshold criteria** are requirements that each alternative must meet to be eligible for selection as the preferred alternative, and include overall protection of human health and the environment and compliance with ARARs (unless a waiver is obtained).

- **Primary balancing criteria** are used to weigh effectiveness and cost tradeoffs among alternatives. The primary balancing criteria include long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost. The primary balancing criteria represent the main technical criteria upon which the alternative's evaluation is based.

- **Modifying criteria** include State acceptance and community acceptance, and may be used to modify aspects of the preferred alternative when preparing the ROD. Modifying criteria are generally evaluated after public comment on the PRAP. Accordingly, only the seven threshold and primary balancing criteria are part of the detailed analysis phase.

6.1 NCP Overview of Evaluation Criteria

The nine evaluation criteria developed by the USEPA are described in the following subsections. Table 6-1 provides details on the analysis factors and considerations during the analysis of each alternative for NCP Criteria 1 through 6.

6.1.1 Criterion 1—Overall Protection of Human Health and the Environment

This threshold evaluation criterion assesses how each alternative provides and maintains adequate protection of human health and the environment. Alternatives are assessed to determine whether they can adequately protect human health and the environment from unacceptable risks posed by contaminants present at the site, in both the short and long-term. This criterion is also used to evaluate how risks would be eliminated, reduced, or controlled through treatment, engineering, institutional controls, or other remedial activities. The considerations evaluated during the analysis of each alternative for overall protection of human health and the environment are presented in Table 6-1.

6.1.2 Criterion 2—Compliance with ARARs

This threshold evaluation criterion is used to determine if each alternative would comply with Federal and State ARARs, or whether invoking waivers to specific ARARs is adequately justified. Other information, such as advisories, criteria, or guidance, is considered where appropriate during the ARARs analysis. The considerations evaluated during the analysis of the ARARs applicable to each alternative are presented in Table 6-1. Potential action-, location-, and chemical-specific ARARs for the alternatives presented in this FS are identified in Appendix B and summarized in Section 3.2.

6.1.3 Criterion 3—Long-term Effectiveness and Permanence

This primary balancing evaluation criterion addresses the long-term effectiveness and permanence of maintaining the protection of human health and the environment after implementing the remedial action imposed by the alternative. The primary components of this criterion are the magnitude of residual risk remaining at the site after remedial objectives have been met, and the extent and effectiveness of controls that might be required to manage the risk posed by treatment residuals and/or untreated wastes. The considerations evaluated during the analysis of each alternative for long-term effectiveness and permanence are presented in Table 6-1.

6.1.4 Criterion 4—Reduction of Toxicity, Mobility, or Volume through Treatment

This primary balancing evaluation criterion addresses the anticipated performance of the alternative's treatment technologies in permanently and significantly reducing toxicity, mobility, and/or volume of hazardous materials at the site. The NCP prefers remedial actions where treatment is used to reduce the principal threats at a site through destruction of toxic contaminants, irreversible reduction in contaminant mobility, or reduction of total volume of contaminated media. The considerations evaluated during the analysis of each alternative for reduction of toxicity, mobility, or volume of contaminants present at a given site are presented in Table 6-1.

6.1.5 Criterion 5—Short-term Effectiveness

This primary balancing evaluation criterion considers the effect of each alternative on the protection of human health and the environment during the construction and implementation process. The short-term effectiveness evaluation only addresses protection prior to meeting the RAO. The considerations evaluated during the analysis of each alternative for short-term effectiveness are presented in Table 6-1.

6.1.6 Criterion 6—Implementability

This primary balancing criterion evaluates the technical feasibility and administrative feasibility (i.e., the ease or difficulty) of implementing each alternative and the availability of required services and materials during its implementation. The considerations evaluated during the analysis of each alternative for implementability are presented in Table 6-1.

6.1.7 Criterion 7—Cost

This primary balancing criterion evaluates the cost of implementing each alternative. The cost of an alternative encompasses all engineering, construction, and long-term future (e.g., O&M) costs incurred over the life of the project. The cost of each alternative is to be developed with an expected accuracy range of –30 to +50 percent (USEPA, 1988).

These estimates were based on similar project experience, industry knowledge, and cost estimating references, as well as information provided by vendors, subcontractors, and regulators. However, these cost estimates were used to compare the alternatives, not to bid the work. The costs of the remedial alternatives are compared using the estimated present value (PV) of the capital and long-term costs (e.g., O&M) of the alternative in current year (2009) dollars. The PV allows costs for remedial alternatives to be compared by discounting all costs to the year that the alternative is implemented.

The PV concept captures the time value of money by adjusting through compounding and discounting cash flows to reflect the increased value of money when invested. The present value of a cash flow reflects in today's terms, the value of future cash flows adjusted for the cost of capital.

Each alternative's PV cost was calculated using the real discount rate found in *Appendix C of Office of Management and Budget (OMB) Circular A-94* (OMB, December 2008). The real discount rate used for alternatives with durations of 30 years or longer is 2.7 percent. Uncertainties that may affect the actual cost of each alternative are discussed in Section 5. The estimated PV cost of each alternative is provided in Table 6-2. A summary of implementation and future costs for each alternative is provided in Table 6-3.

6.1.8 Criterion 8—State Acceptance

The assessment of this modifying criteria includes the technical and administrative issues and concerns the State of North Carolina may have regarding each of the alternatives. NCDENR reviewed a draft of this FS, and their comments were incorporated in the final version.

6.1.9 Criterion 9—Community Acceptance

The assessment of this modifying criteria includes the issues and concerns the public may have regarding each of the alternatives. As with regulatory acceptance, community concerns will be used to evaluate each remedy in this FS. Consistent with the NCP, public comments will be solicited on the selected alternative presented in the PRAP. Any comments will be addressed in the ROD, and will be considered in the selection of the remedy.

6.2 Evaluation and Comparison of Alternatives Against NCP Criteria

Table 6-2 presents a detailed summary and comparison of the five alternatives based on each alternatives merits in the NCP evaluation criteria.

6.3 Path Forward

This FS provides to the Navy and other stakeholders information necessary to select the most appropriate remedial action for OU14. The Partnering Team will select the preferred alternative(s) for OU14 and document the selection in a PRAP. The PRAP will be subject to public review and comment. Following consideration of public comments, the final remedy for the site will be documented in a ROD. The RD and remedial action for OU14 will be performed in accordance with the requirements contained in the ROD.

TABLE 6-1
NCP Criteria Analysis Factors and Considerations
Operable Unit 14, Site 90 Feasibility Study
MCAS Cherry Point, North Carolina

Analysis Factors	Considerations
Criterion 1 – Overall Protection of Human Health and the Environment	
Human Health Protection	Likelihood that the alternative reduces risk to human health through exposure to contaminants in soil by direct contact, ingestion, or inhalation.
Environmental Protection	Likelihood that the alternative reduces the threat to unaffected groundwater, soil, surface water by minimizing migration of contaminants.
	Likelihood that the alternative reduces risk to ecological receptors.
Criterion 2 – Compliance with ARARs	
Chemical-specific ARARs	Likelihood that the alternative will achieve compliance with chemical-specific ARARs within a reasonable time.
	If it appears that compliance with chemical-specific ARARs will not be achieved, then evaluation of whether a waiver is appropriate must be completed.
Location-specific ARARs	Determination of whether any location-specific ARARs (e.g., preservation of wetlands) apply to the alternative.
	Likelihood that the alternative will achieve compliance with the location-specific ARAR.
	If the location-specific ARAR cannot be met, evaluation of whether a waiver is appropriate must be completed.
Action-specific ARARs	Likelihood that the alternative will achieve compliance with action-specific ARARs (e.g., hazardous waste treatment regulations).
Other Criteria and Guidance	Likelihood that the alternative will achieve compliance with other criteria, such as risk-based criteria.
Criterion 3 – Long-term Effectiveness and Permanence	
Magnitude of Residual Risks	Identity of remaining risks (risks from treatment residuals) as well as risks from untreated residual contamination.
	Magnitude of the remaining risks.
Adequacy and Reliability of Controls	Likelihood that the technologies will meet required process efficiencies or performance specifications.
	Type and degree of long-term management required.
	Long-term monitoring requirements.
	O&M functions that must be performed.
	Difficulties and uncertainties associated with LTO&M functions.
	Potential need for technical components replacement.
	Magnitude of threats or risks should the remedial action need replacement.
	Degree of confidence that controls can adequately handle potential problems.
	Uncertainties associated with land disposal of residuals and untreated wastes.
Criterion 4 – Reduction of Toxicity, Mobility, or Volume through Treatment	
Treatment Process and Remedy	Likelihood that the treatment process addresses the principal threat.
	Special requirements for the treatment process.
Amount of Hazardous Material Destroyed or Treated	Portion (mass) of contaminant that is destroyed.
	Portion (mass) of contaminant that is treated.
Reduction in Toxicity, Mobility, or Volume	Extent that the total mass of contaminants is reduced.
	Extent that the mobility of contaminants is reduced.
	Extent that the volume of contaminants is reduced.
Irreversibility of Treatment	Extent that the effects of the treatment are irreversible.
Type and Quantity of Treatment Residual	Residuals that will remain.
	Quantities and characteristics of the residuals.
	Risk posed by the treatment.
Statutory Preference for Treatment as a Principal Element	Extent to which the scope of the action covers the principal threats.
	Extent to which the scope of the action reduces the inherent hazards posed by the principal threats at the site.

TABLE 6-1
NCP Criteria Analysis Factors and Considerations
Operable Unit 14, Site 90 Feasibility Study
MCAS Cherry Point, North Carolina

Analysis Factors	Considerations
Criterion 5 – Short-term Effectiveness	
Protection of the Community during the Remedial Action	Risks to the community that must be addressed.
	How the risks will be addressed and mitigated.
	Remaining risks that cannot be readily controlled.
Protection of Workers during Remedial Actions	Risks to the workers that must be addressed.
	How the risks will be addressed and mitigated.
	Remaining risks that cannot be readily controlled.
Environmental Impacts	Environmental impacts that are expected with the construction and implementation of the alternative.
	Mitigation measures that are available and their reliability to minimize potential impacts.
	Impacts that cannot be avoided, should the alternative be implemented.
Time until RAOs Are Achieved	Time to achieve protection against the threats being addressed.
	Time until any remaining threats are addressed.
	Time until RAOs are achieved.
Criterion 6 – Implementability	
Technical Feasibility	
Ability to Construct and Operate the Technology	Difficulties associated with the construction.
	Uncertainties associated with the construction.
Reliability of the Technology	Likelihood that technical problems will lead to schedule delays.
Ease of Undertaking Additional Remedial Action	Likely future remedial actions that might be anticipated.
	Difficulty implementing additional remedial actions.
Monitoring Considerations	Migration or exposure pathways that cannot be monitored adequately.
	Risks of exposure, should the monitoring be insufficient to detect failure.
Administrative Feasibility	
Coordination with Other Agencies	Steps required to coordinate with regulatory agencies.
	Steps required to establish long-term or future coordination among agencies.
	Ease of obtaining permits for offsite activities, if required.
Availability of Services and Materials	
Availability of Treatment, Storage Capacity, and Disposal Services	Availability of adequate treatment, storage capacity, and disposal services.
	Additional capacity that is necessary.
	Whether lack of capacity prevents implementation.
	Additional provisions required to ensure that additional capacity is available.
Availability of Necessary Equipment and Specialists	Availability of adequate equipment and specialists.
	Additional equipment or specialists that are required.
	Whether there is a lack of equipment or specialists.
	Additional provisions required to ensure that equipment and specialists are available.
Availability of Prospective Technologies	Whether technologies under consideration are generally available and sufficiently demonstrated.
	Further field applications needed to demonstrate that the technologies could be used full scale to treat the waste at the site.
	When technology should be available for full-scale use.
	Whether more than one vendor will be available to provide a competitive bid.

Table 6-2
Comparative NCP Criteria Analysis Matrix
Operable Unit 14, Site 90 Feasibility Study
MCAS Cherry Point, North Carolina

NCP Evaluation Criteria			Alternative 1 No Action	Alternative 2 Land-Use Controls (LUCs)	Alternative 3 Monitored Natural Attenuation (MNA) and LUCs	Alternative 4 Biosparge, MNA, and LUCs	Alternative 5 Enhanced Reductive Dechlorination (ERD), MNA, and LUCs
NCP Criteria	Threshold Criteria	**Overall Protection of Human Health and the Environment**	Will not meet RAOs. Human health risks associated with potential receptors and the potential future use of groundwater as a potable source.	Will not meet RAOs completely. Restricts human exposure via institutional controls; however, there will still be human health risks associated with the potential future use of groundwater as a potable source.	This alternative will meet RAOs over time via natural attenuation mechanisms, which are effective but slower than more aggressive treatment options.	Will meet RAOs for groundwater passing through Biosparge zone of influence by promoting aerobic biological degradation and mass transfer by volatilizing dissolved phase CVOCs. Remainder of plume areas will meet RAOs over time via natural attenuation mechanisms.	Will meet RAOs where groundwater migrates past injection sites by promoting anaerobic biological degradation. Remainder of plume areas will meet RAOs over time via natural attenuation mechanisms.
		Compliance with ARARs [(a)]	Does not comply with chemical-specific or location-specific ARARs.	Does not comply with chemical-specific ARARs. No monitoring of COC concentrations or COC migration. LUCs in combination with other alternatives will comply with ARARs. LUCs will be part for Alternatives 3, 4, and 5.	Complies with ARARs. RI data showed no exceedances in surface water or sediment in the stream and concluded that the plumes have stabilized and attenuate (biodegrade, disperse, dilute, etc.) to below NC2L standards before discharging into the stream.	Complies with ARARs. No fugitive emissions for Biosparging due to lower air injection rate and de minimis emission rate compared to actual point sources, vehicular traffic, and aircraft. No air permitting required.	Complies with ARARs. Food-grade electron donor material to be injected has been performed at other DOD facilities in NC (e.g., MCB Camp Lejeune). COCs concentratinos would meet NC2L standards via anaerobic biodegradation processes and MNA mechanisms.
	Primary Balancing Criteria	**Long-term Effectiveness and Permanence**	As this is not a treatment or institutional control, it will technically not reduce risk; therefore, is not effective in the long-term. However, risk will be reduced over a longer period of time via natural attenuation, but there will be no mechanism to monitor COC concentrations and to assess remedial progress.	Expected to be an effective remedy for protection of human health if enforced in perpetuity, but not for treatment of groundwater (no permanent risk reduction is possible considering only LUCs since remedial progress is not monitored in this alternative). However, LUCs will be implemented with either of Alternatives 3-5. O&M includes quarterly inspections and reporting (same for Alternativese 3-5). Five-Year Reviews are included in this alternative. The Navy uses a Web-based management tool, *LUC Tracker* , as part of the Naval Installation Restoration Information System (NIRIS).	Expected to be an effective and permanent remedy for treatment of groundwater contaminated with CVOCs over a longer period of time. Permanent risk reduction is probable - contaminants must attenuate below the appropriate standards. Also, current (and future) UST Program AS remedial systems will treat groundwater contaminated with CVOCs. O&M includes maintaining LUCs, periodic monitoring well repairs, and performance monitoring (same for Alternatives 4 & 5).	Expected to be an effective and permanent remedy (in combination with LUCs, and with MNA after Biosparge performance goals are met [to be defined during the remedial design phase]) for treatment of groundwater contaminated with CVOCs to below cleanup levels. However, considerable O&M over the other alternatives b/c this alternative needs power, housing locations for the sparging equipment (until the remedy is complete), and frequent maintenance to keep operable (e.g., compressed air systems). Common O&M includes maintaining LUCs, periodic monitoring well repairs, and performance monitoring (same for Alternatives 3 & 5).	Expected to be an effective and permanent remedy (when coupled with Alternative 3 - MNA after ERD performance goals are met [to be defined during the remedial design phase] and substrate injections cease) for treatment of groundwater contaminated with CVOCs to below cleanup levels. O&M includes maintaining the numerous injection wells to be installed. Multiple injections every ~4 years to maintain the strongest ERD condition. Aquifer must be buffered to maintain optimal pH for ERD. Common O&M includes maintaining LUCs, periodic monitoring well repairs, and performance monitoring (same for Alternatives 3 & 4). However, UST Program AS systems will impede ERD by creating aerobic zones in the vicinity of each AS network.
		Reduction of Toxicity, Mobility or Volume Through Treatment	As this is not a treatment, it will technically not reduce toxicity, mobility, and volume. However, reductions will occur over a longer period of time via natural attenuation mechanisms, but there will be no mechanism to monitor the progress of these reductions.	Reduces toxicity, mobility, and volume over a prolonged period of time by natural attenuation, but no mechanism to measure or document remedial progress. LUCs in combination with other alternatives will satisfy this criteria. LUCs will be part for Alternatives 3, 4, and 5.	Reduces toxicity, mobility, and volume over a prolonged period of time by naturally degrading, dispersing, volatilizing, and diluting contaminants.	Reduces toxicity, mobility, or volume through mass transfer to volatilize dissolved phase VOCs and promotion of aerobic biodegradation, followed by other natural attenuation mechanisms. Will generate more drilling fluids and cuttings for characterization and disposal than Alternative 3.	Reduces toxicity, mobility, or volume through promotion of anaerobic biodegradation, followed by other natural attenuation mechanisms. Will generate more drilling fluids and cuttings for characterization and disposal that Alternative 3.
		Short-term Effectiveness	No short-term impacts because nothing is implemented.	No short-term impacts because an active remedy is not implemented. But immediately protects human health as enforced.	Requires standard engineering and safety controls during well installations and monitoring (same as Alternatives 4 & 5) to protect the environment and site workers.	Requires engineering and safety controls during drilling of both monitoring wells and Biosparge wells (horizontal drilling), and operation of the system, in order to protect environment and site workers. Increased monitoring would be required during the duration of remediation.	Requires engineering and safety controls during drilling and injection to protect environment to protect environment and site workers. Multiple injections and increased monitoring would be required during the duration of remediation.

Table 6-2
Comparative NCP Criteria Analysis Matrix
Operable Unit 14, Site 90 Feasibility Study
MCAS Cherry Point, North Carolina

NCP Evaluation Criteria			Alternative 1 No Action	Alternative 2 Land-Use Controls (LUCs)	Alternative 3 Monitored Natural Attenuation (MNA) and LUCs	Alternative 4 Biosparge, MNA, and LUCs	Alternative 5 Enhanced Reductive Dechlorination (ERD), MNA, and LUCs
NCP Criteria	Primary Balancing Criteria	**Implementability**	No construction or operation.	Easily implementable. Virtually no disruption to site operations during implementation. Minor disruption to protocol for intrusive or construction activities.This alternative is administratively feasible.	Services and materials are available and the technology is easily implementable. Additional monitoring well installations will be somewhat of a challenge due to utilities and site operations, but generally the same wells are also required for Alternatives 4 & 5 (however, Alternatives 4 & 5 will need additional performance monitoring wells than Alternative 3). Minor disruption to site operations during groundwater monitoring events. This alternative is administratively feasible.	The number of qualified environmental HDD subcontractors is relatively limited. HDD wells have been implemented successfully at many sites in place of vertical wells. Use of HDD will significantly reduce utility conflicts. Installation of numerous monitoring wells, in addition to Biosparge system conveyance piping and electrical wiring, will be challenging based on current site operations and utilities. Considerable O&M over the other alternatives b/c of electricity consumption, housing structures for the Biosparge equipment, and frequent system maintenance: level of effort associated with O&M for rotary screw air compressors is low, but must be performed on a relatively frequent basis (at least quarterly, with monthly system checks). Minor disruption to site operations during O&M and groundwater monitoring events. This alternative is administratively feasible, but will require more coordination with different parties throughout the remedy implementation. May temporarily impede UST Program FP recovery systems due to initial mounding effect during and immediately after system startup. The injection of air into the aquifer increases the risk of resulting indoor air vapor intrusion issues relative to the other alternatives. Indoor air vapor mitigation systems (passive or active) or SVE may be necessary depending on building occupancy.	Services and materials are available. Injection wells can be installed by an experienced environmental drilling company. Technology is easily implementable; however, the installation of numerous monitoring and injection wells will be challenging based on current site operations and utilities. Disruption of site activities in vicinity during multiple manifolded injections. Minor disruption to site operations during groundwater monitoring events. This alternative is administratively feasible. However, UST Program AS systems introducing air (i.e., oxygen) into the aquifer will interfere with ERD technology by impeding development/enhancement of anaerobic, reducing conditions.
		Cost [(b)] *2009 Present Value* *(-30% to +50%)*	$0	$706,000 *($494,000 to $1,059,000)* ●Evaluated over a 100-Year timeframe as a stand-alone alternative for reference.	$2,077,000 *($1,454,000 - $3,115,000)* ●Evaluated over 100-year timeframe.	$5,076,000 *($3,553,000 - $7,614,000)* ●Evaluated over 40-year timeframe. ●May require some integration/coordination with UST Program AS system operations and future expansion.	$6,208,000 *($4,346,000 - $9,311,000)* ●Evaluated over 60-year timeframe.
	Modifying Criteria	**State Acceptance**	This alternative is not likely to be accepted by NCDENR.	This alternative alone is not likely to be accepted by NCDENR.	Based on the absence of current risk, the improbability of future risk due to a stable plume and continued military operations in the foreseeable future, and the considerable cost advantage, this alternative is likely to be accepted by NCDENR.	This alternative is likely to be accepted by the NCDENR.	Apart from the high cost, this alternative is likely to be accepted by the NCDENR.
		Community Acceptance	This alternative is not likely to be accepted by the community.	This alternative alone is not likely to be accepted by the community.	This alternative is likely to be accepted by the community.	This alternative is likely to be accepted by the community, although the higher cost may lower community acceptance.	The community is likely to accept this technology, but the high cost is likely to lower community acceptance.

Notes
(a) See USEPA Legal Recommended list of ARARs in Appendix B.
(b) See cost summaries in Table 6-3. Current OMB (2008) Discount Rate of 2.7% for >30-year period. Also see cost estimate backup in Appendix C.

Table 6-3
Summary of Cost Analysis
Operable Unit 14, Site 90 Feasibility Study
MCAS Cherry Point, North Carolina

Alternative		Alternative 1 No Action	Alternative 2 LUCs			Alternative 3 MNA			Alternative 4 Biosparge, MNA, & LUCs			Alternative 5 ERD, MNA, & LUCs		
Alternative Evaluation Timeframe[1]		0 years	~~30~~ 100 years			100 years			40 years			60 years		
			-30%	**Estimate**	*+50%*	*-30%*	**Estimate**	*+50%*	*-30%*	**Estimate**	*+50%*	*-30%*	**Estimate**	*+50%*
Total Implementation Costs		**$0**	*$8,000*	$11,000	*$17,000*	*$289,000*	$413,000	*$620,000*	*$1,254,000*	$1,792,000	*$2,687,000*	*$1,558,000*	$2,225,000	*$3,338,000*
Present Value of Future Costs	Discount Rate of 2.7% (OMB, 2008)	**$0**	*$486,000*	$695,000	*$1,042,000*	*$1,164,000*	$1,663,000	*$2,494,000*	*$2,299,000*	$3,284,000	*$4,926,000*	*$2,788,000*	$3,982,000	*$5,973,000*
Grand Total Present Value	Discount Rate of 2.7% (OMB, 2008)	**$0**	*$494,000*	**$706,000**	*$1,059,000*	*$1,453,000*	**$2,076,000**	*$3,114,000*	*$3,553,000*	**$5,076,000**	*$7,613,000*	*$4,346,000*	**$6,207,000**	*$9,311,000*

Notes and References:

● The 100-year timeframe evaluated for Alternative 2-LUCs is for reference. The cost of LUCs are built into each of Alternatives 3, 4, and 5 for each alternative's respective timeframe (100 years, 40 years, and 60 years, respectively).

● The "Real" Discount Rate used to calculate the Present Value cost is 2.7% for a timeframe greater than 30 years per the Office of Management and Budget (OMB), Circular A-94, Appendix C, Revised December 2008, "Discount Rates for Cost Effectiveness, Lease Purchase, and Related Analysis" for Calendar Year 2009, http://www.whitehouse.gov/omb/circulars_a094_a94_appx-c/.

The Real Discount Rates are a forecast of real interest rates from which the inflation premium has been removed and based on the economic assumptions from the December 2010 Budget Baseline. These real rates are to be used for discounting constant-dollar flows, as is often required in cost-effectiveness analysis.

● USEPA. 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. OSWER Directive 9355.3-01. EPA/540/G-89/004. October.

● USEPA. 2000. A Guide to Developing and Documenting Cost Estimates During the Feasibility Study. With the U.S. Army Corps of Engineers. OSWER 9355.0-75. EPA 540-R-00-002. July.

● The information in this cost estimate is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during Baseline Sampling and the Remedial Design phase. This is an order-of-magnitude engineering cost estimate that is expected to be within –30 to +50 percent of the actual project cost (per USEPA, 1988 and 2000).

[1]The Alternative Evaluation Timeframes listed for Alternatives 3, 4, and 5 are conservative estimates. The estimates do not take into account the presence of (1) POL contamination and it's potential to facilitate and expedite biodegradation by providing an energy source to naturally-occurring bacteria; and (2) UST Remediation Systems, which, depending on aquifer conditions, can facilitate or impede the removal and degradation of various CVOCs.

SECTION 7

References

AFCEE (Air Force Center for Environmental Excellence). 2003. *Aqueous and Mineral Intrinsic Bioremediation Analysis (AMIBA) of the Pine Bark Mulch Permeable Barrier at Altus Air Force Base SWU-7 (OU-1)*. San Antonio, Texas.

AFCEE. 2004. *Final Principles and Practices of Enhanced Anaerobic Bioremediation of Chlorinated Solvents*. Prepared by Parsons Corp. for AFCEE. August.

AFCEE. 2007. *Final Protocol for In Situ Bioremediation of Chlorinated Solvents Using Edible Oil*. Prepared by Solutions IES, Inc. for AFCEE. October.

A.T. Kearney, Inc., 1988. *Interim RCRA Facility Assessment Report*, U.S. Marine Corps Air Station Cherry Point, NC. June.

Baker, 2002. *Final Natural Attenuation Evaluation Report, Operable Unit No. 21 (Site 73), Marine Corps Base Camp Lejeune, North Carolina*. CH2M HILL, Baker, and CDM. January.

Broholm et al. 1991. *Laboratory feasibility studies on biological in-situ treatment of a sandy soil contaminated with chlorinated aliphatics*. K. Broholm, T.H. Christensen, and B.K. Jensen. Environmental Technology. 12: 279-289. 1991.

Butler, E.C. and K.F. Hayes. 1999. *Kinetics of the Transformation of Trichloroethylene and Tetrachloroethylene by Iron Sulfide*. Environmental Science & Technology, Vol. 33(12):2021-2027.

CH2M HILL, 2008. *Final Remedial Investigation, Operable Unit 14, Site 90, Marine Corps Air Station, Cherry Point, North Carolina*. December.

Devlin, J.F. and D. Muller. 1999. *Field and Laboratory Studies of Carbon Tetrachloride Transformation in a Sandy Aquifer under Sulfate Reducing Conditions*. Environmental Science & Technology, Vol. 33:1021-1027.

Eimers, J.L., Daniel, C.C., and Coble, R.W. *Hydrogeology and Simulation of Ground-Water Flow at U.S. Marine Corps Air Station Cherry Point, NC,* USGS Water Resources Investigations Report 1987-90. 1994.

EOS Remediation. 2008. http://www.eosremediation.com.

ESTCP. 2006. *Protocol for Enhanced In Situ Bioremediation Using Emulsified Edible Oil*. Prepared by IES-Solutions, Inc. for/with the Environmental Security Technology Certification Program. May.

Henson et al. *Microbial Removal of Halogenated Methanes, Ethanes, and Ethylenes in an Aerobic Soil Exposed to Methane*. J.M. Henson, M.V. Yates, J.W. Cochran J.W., and D.L. Shackleford. FEMS Microbiology Ecology. 53:193-201. 1988.

HNUS (Halliburton NUS), 1994. *Site Characterization and Evaluation Report for BRAC Sites 6 and 7 for Marine Corps Air Station, Cherry Point, NC*. December.

Howard et al. 1991. *Handbook of Environmental Degradation Rates*. Philip H. Howard, Robert S. Boethling, William F. Jarvis, William M. Meylan, Edward M. Michalenko. Lewis Publishers.

ITRC (Interstate Technology & Regulatory Council). 1999. *Natural Attenuation of Chlorinated Solvents in Groundwater: Principles and Practices*. May.

ITRC. 2005. *Permeable Reactive Barriers: Lessons Learned/New Directions*. PRB-4. Washington, D.C.: ITRC, Permeable Reactive Barriers Team. Available on the Internet at www.itrcweb.org.

Jones (J.A. Jones Environmental Services Company), 2000. *Work Plan, Task Order 045, RAC Action for Statement of Work Design, Subsurface Petroleum Remediation, Buildings 130 and 3996, Marine Corps Air Station, Cherry Point, NC*. June.

Law Engineering. 1995. *Leaking Underground Pipeline Site Assessment Report, Building 130, Marine Corps Air Station, Cherry Point, NC*. June.

Law Engineering. 1996. *Addendum Comprehensive Site Assessment Report, Building 130, Marine Corps Air Station, Cherry Point, NC*. March.

Law Engineering. 1997. *Corrective Action Plan for the Recovery of Free Product and the Restoration of Petroleum Contaminated Soil and Groundwater, Building 130, Building 3996, and Pit 4 Area, Marine Corps Air Station, Cherry Point, NC*. January.

Lee, W. and B. Batchelor. 2003. *Reductive Capacity of Natural Reductants*. Environmental Science & Technology, Vol. 37:535-541.

Lige et al. *Treatability study to evaluate in situ chlorinated solvent and pesticide bioremediation*. Bioremediation of Chlorinated Solvents. J.E. Lige, I.D. MacFarlane, and T.R. Hundt [Pap. Interntl. In Situ On-Site Bioreclam. Symp.] 3rd. Hinchee R.E. et. al. (eds.). Battelle Press: Columbus, OH. pp. 313-320. 1995.

Maymo-Gatell, et al. 1997. *Isolation of a bacterium that reductively dechlorinates tetrachloroethene to ethene*. X. Maymo-Gatell, Y. Chien, J.M. Gossett, and S.H. Zinder. Science, Vol. 276:1568-1571.

Murray, Jr., L.C. and L.M. Keoughan. 1990. "Hydrogeologic Setting, Water Levels, and Quality of Water from Monitoring Wells at the U.S. Marine Corps Air Station Cherry Point, NC." *USGS Water Resources Investigations Report* 89-4200.

NAVFAC (Naval Facilities Engineering Command). 2005. *Federal Facility Agreement for Marine Corps Air Station Cherry Point, North Carolina*. USEPA Administrative Docket Number CERCLA-04-2005-3766. U.S. Navy signature on December 13, 2004. USEPA Region 4 signature on January 3, 2005. North Carolina Department of Environment and Natural Resources signature on January 25, 2005.

NAVFAC Groundwater Risk Management Overview and Tools. http://www.ert2.org/GWRM/tool.aspx.

NC (North Carolina) Administrative Code (NCAC). NC Department of Natural Resources, Division of Water Quality. http://www.enr.state.nc.us/html/rules.html.

NCAC. NC Department of Natural Resources, Division of Waste Management. http://wastenot.enr.state.nc.us/laws.htm.

NCAC. *Classifications of Water Quality Standards Applicable to the Groundwaters of NC*. NC Administrative Code 15A NCAC 02L.0100, .0200, & .0300. http://h2o.enr.state.nc.us/admin/rules/documents/WEBversioncomp2Lw-PFOAInterim_dec06.pdf. Amended December 7, 2006.

NCAC, 2007. *Surface Waters and Wetlands Standards*. NC Administrative Code 15A NCAC 02B.0100, .0200, & .0300. http://h2o.enr.state.nc.us/admin/rules/documents/redbook_1may07_full_with_cover.pdf. Amended May 1, 2007.

Nyer, Evan et al. 2001. *In Situ Treatment Technology*. CRC Press. Washington, D.C.

ORNL (Oak Ridge National Laboratory). 2008. *Ecological Risk Analysis: Guidance, Tools, and Applications. Net Environmental Benefit Analysis*. Prepared by the Environmental Sciences Division (ESD) and Life Sciences Division for the U.S. Department of Energy.

OMB (Office of Management and Budget. 2008. OMB Circular No. A-94, Revised December 2008, "Discount Rates for Cost Effectiveness, Lease Purchase, and Related Analysis". http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html.

Federal Remediation Technologies Roundtable, 2002 and 2007. *Remediation Technologies Screening Matrix and Reference Guide*, Version 4.0. http://www.frtr.gov/.

R. S. Means. 2001. *Environmental Cost Data – Unit Prices*.

R. S. Means. 2002. *Environmental Cost Data – Assemblies*.

R. S. Means. 2007a. *Site Work and Landscape Cost Data*.

R. S. Means. 2007b. *Heavy Construction Cost Data*.

Scholz-Muramatsu et al. 1995. *Isolation and characterization of* Dehalospirillum multivorans *gen. nov., sp. nov., a tetrachloroethene-utilizing, strictly anaerobic bacterium*. H. Scholz-Muramatsu, A. Neumann, M. Meßmer, E. Moore, and G. Diekert. Archives of Microbioly 163, 48–56

Schumacher and Hollinger. 1996. *The proton/electron ratio of the menaquinone-dependent electron transport from dihydrogen to tetrachloroethene in* Dehalobater restrictus. Journal of Bacteriology, 178: 2328-2333.

Suthersan, Suthan and F. Payne. 2005. *In Situ Remediation Engineering*. CRC Press. Washington, D.C.

TTNUS. 1999. *Background Evaluation Report for MCAS Cherry Point, NC*. October.

TTNUS (TetraTech NUS). 2002. *Final Remedial Investigation Report for OU1, Marine Corps Air Station Cherry Point, NC*. November.

USEPA (U.S. Environmental Protection Agency). 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*. OSWER Directive 9355.3-01. EPA/540/G-89/004. October.

USEPA. 1989a. *RCRA Section 3008(h) Administrative Order on Consent for Marine Corps Air Station Cherry Point, North Carolina.* USEPA Docket Number 89-13-R. December.

USEPA. 1989b. *CERCLA Compliance with Other Laws Manual: CERCLA Compliance with State Requirements. Quick Reference Fact Sheet*. OSWER Publication 9234.2-05/FS. December.

USEPA. 1991. *ARARs Q's & A's: General Policy, RCRA, CWA, SDWA, Post-ROD Information, and Contingent Waivers. Quick Reference Fact Sheet*. OSWER Publication 9234.2-01/FS-A. July.

USEPA. 1997. *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites, Draft – Interim Final*. OSWER Directive No. 9200.4-17. Washington D.C. December 1.

USEPA. 1998. *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water*. United States Environmental Protection Agency. September. EPA/600/R-98/128.

USEPA. 1999a. *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites*. Office of Solid Waste and Emergency Response (OSWER) Directive 9200.4-17P. April 21.

USEPA. 1999b. *Aerobic Biodegradation of Organic Chemicals in Environmental Media: A Summary of Field and Laboratory Studies*. SRC TR 99-002. Jan 27.

USEPA. 2000. *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*. With the U.S. Army Corps of Engineers. OSWER 9355.0-75. EPA 540-R-00-002. July.

USEPA. 2001a. On-line aquatic toxicity database. http://cfpub.epa.gov/ecotox/

USEPA. 2001b. Region 4 Ecological Screening Values (ESV). http://www.epa.gov/region4/waste/ots/ecolbul.htm.

USEPA. 2004. *Performance Monitoring of MNA Remedies for VOCs in Ground Water*. EPA/600/R-04/027. April.

USEPA. 2005. *Revised Region 3 BTAG screening values*. http://www.epa.gov/reg3hwmd/risk/eco/index.htm

USEPA. 2006. *National Recommended Water Quality Criteria for Priority Toxic Pollutants*. Office of Water, Office of Science and Technology. Section 304(a) of the Clean Water Act (CWA). http://www.epa.gov/waterscience/criteria/wqctable/nrwqc-2006.pdf.

USEPA. 2008a. *Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites*. Office of Solid Waste and Emergency Response. EPA 542-R-08-002. April.

USEPA. 2008b. *USEPA National [Human Health Risk-Based] Screening Values*. Last update - September 12, 2008. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm. Maintained by Oak Ridge National Laboratory (ORNL). September 12.

USGS (U.S. Geological Survey). 1996. *Application of Geophysical Methods for the Delineation of Paleochannels and Missing Confining Units Above the Castle Hayne Aquifer at U.S. Marine Corps Air Station, Cherry Point, North Carolina*. Water-Resources Investigation Report 94-4186.

Wackett, L.P. and C.P. Hershberger. 2001. *Biocatalysis and Biodegradation.* ASM Press. Washington, D.C.

Water and Air Research, Inc. 1983. *Initial Assessment Study of Marine Corps Air Station Cherry Point, NC,* Prepared for Naval Energy and Environmental Support Activity (NEESA). March.

Appendix A
Analytical Data, Figures, and Other Information from the OU14 Remedial Investigation

Table 3-1
Summary of Remedial Investigation Activities
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Field Investigation Activity	OU14	
Direct Push and/or Split Spoon Subsurface Soil Sampling	**Samples**	**Duplicates**
Phase I Samples (October 2002)	9	1
Phase III Samples (February 2005)	14	3
Additional Sample from location 9009SB (September 2008)	1	
Total RI Samples	**24**	**4**
Direct Push Technology Groundwater Sampling	**Samples**	**Duplicates**
Phase I Samples (October 2002)	53	6
Phase III Samples (April 2005)	39	4
Total RI Samples	**92**	**10**
Upper Surficial Groundwater Sampling	**Samples**	**Duplicates**
Phase II Samples (October 2003)	32	4
Phase III Samples (April 2005)	25	2
Total RI Samples	**57**	**6**
Lower Surficial Groundwater Sampling	**Samples**	**Duplicates**
Phase II Samples (October 2003)	23	3
Phase III Samples (April 2005)	17	4
Total RI Samples	**40**	**7**
Yorktown Aquifer Groundwater Sampling	**Samples**	**Duplicates**
Phase III Samples (April 2005)	2	1
Additional Sample from Monitoring Well OU14-90GW17 (August 2007)	1	1
Total RI Samples	**3**	**2**
Surface Water Sampling	**Samples**	**Duplicates**
Phase III Samples (April 2006)	6	1
Total RI Samples	**6**	**1**
Sediment Sampling	**Samples**	**Duplicates**
Phase III Samples (April 2006)	6	1
Total RI Samples	**6**	**1**
New Monitoring Well Installation Events		
Phase III (February 2005) (by AGVIQ/CH2M HILL JV I)	8 Upper Surficial Aquifer 8 Lower Surficial Aquifer 2 Yorktown Aquifer	
Groundwater Level Monitoring Events		
Phase I Monitoring Events	October 2002	
Phase II Monitoring Events	October 2003	
Phase III Monitoring Events	April 2005	
Slug Tests		
Phase III Rising and Falling Head Tests (March 2005)	5 Upper Surficial Aquifer 4 Lower Surficial Aquifer	

Notes:

- Phase I was conducted in October 2002
- Phase II was conducted in October 2003
- Phase III was conducted in February-April 2005 and April 2006. An additional groundwater sample was collected from Yorktown Aquifer monitoring well 90GW17 in August 2007 to confirm CVOC concentrations. Similarly, an additional soil sample was collected at soil location 9009SB in September 2008 to confirm CVOC concentrations (collected the UST Program in September 2008 during installation of new SVE well during Building 4075 UST Remedial System upgrade activity).

Table 3-2
Sample Analysis Summary
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

	TCL VOCs	RCRA-8 Metals	Nitrate and Sulfate	Geochemistry Suite	Methane, Ethane, and Ethene	TOC	BOD	Hardness	pH	Grain Size
Subsurface Soil										
Phase I (2002)	5	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phase III (2005)	15	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phase III (2008)	1*	NA	NA	NA	NA	NA	NA	NA	NA	NA
Grab Groundwater										
Phase I (2002)	53	NA	NA	NA	NA	NA	NA	NA	field	NA
Phase III (2005)	39	NA	NA	NA	NA	NA	NA	NA	field	NA
Upper Surficial Aquifer Groundwater										
Phase II (2003)	32	32	32	NA	NA	NA	NA	NA	field	NA
Phase III (2005)	25	NA	NA	11	11	11	11	NA	field	NA
Lower Surficial Aquifer Groundwater										
Phase II (2003)	23	23	23	NA	NA	NA	NA	NA	field	NA
Phase III (2005)	17	NA	NA	8	8	8	8	NA	field	NA
Yorktown Aquifer Groundwater										
Phase III (2005)	2	NA	NA	NA	NA	NA	NA	NA	field	NA
Phase III (2007)	1**	NA	NA	NA	NA	NA	NA	NA	field	NA
Sediment										
Phase III (April 2006)	6	6	NA	NA	NA	6	NA	NA	6	6
Surface Water										
Phase III (April 2006)	6	6	NA	NA	NA	NA	NA	6	NA	NA

Notes and Abbreviations:

* Subsurface soil sample location 9009SB was re-sampled in September 2008 (at 7 feet below grade, the same depth sampled in 2002) and analyzed for TCL VOCs.
** Yorktown Aquifer monitoring well OU14-90GW17 was re-sampled in August 2007 and analyzed for low concentration TCL VOCs.
● Geochemistry Suite: Nitrate, Nitrite, Iron, Manganese, Sulfide, Sulfate, and Chloride
● field - pH measurements collected using field water quality meter
● RCRA 8 Metals - Resource Conservation and Recovery Act eight heavy metals: silver, arsenic, barium, cadmium, chromium, mercury, lead, and selenium
BOD - Biological Oxygen Demand
NA - Not Analyzed TOC - Total Organic Carbon
TCL - Target Compound L VOCs - Volatile Organic Compounds

Table 3-3
Monitoring Well Information and Groundwater Elevation Data
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station ID	Installation Date	Screen Depth (ft bgs)	Top of Casing Elevation (ft msl)	April 2005	
				Depth To Water (ft below top of casing)	Groundwater Elevation (ft msl)
Upper Surficial Aquifer					
OU1-MW61	06/12/00	6.7 - 16.7	26.85	6.44	20.41
13GW05	1985	10 - 25	24.79	10.18	14.61
13GW12	10/30/90	5 - 20	23.79	9.65	14.14
13GW15	10/16/90	5 - 20	NA	14.97	NA
13GW16	10/16/90	5 - 20	NA	14.86	NA
13GW17	10/25/90	5 - 20	24.08	9.76	14.32
13GW19	10/29/90	5 - 20	23.48	11.66	11.82
13GW20	10/29/90	5 - 20	23.24	10.35	12.89
13GW21	10/24/90	5 - 20	24.36	11.89	12.47
13GW25	10/24/90	5 - 20	NA	13.34	NA
13GW120A	02/27/01	5 - 20	25.45	12.62	12.83
13GW135	03/01/01	5 - 20	22.23	9.24	12.99
56GW02	12/10/91	7 - 17	23.93	12.07	11.86
56GW06	12/13/91	10 - 20	27.15	16.31	10.84
56GW13	12/19/91	7 - 17	23.60	12.47	11.13
56GW23	02/03/92	7.5 - 17.5	22.33	10.98	11.35
66GW02	09/20/93	7 - 17	24.49	12.08	12.41
66GW03	09/21/93	8.5 - 18.5	25.39	13.15	12.24
66GW05	09/22/93	7 - 17	22.27	10.70	11.57
66GW06	09/21/93	9.5 - 19.5	22.44	12.45	9.99
66GW07	09/21/93	9 - 19	22.41	12.01	10.40
66GW10	09/17/93	5 - 15	21.88	10.09	11.79
66GW20	05/18/94	7 - 17	26.78	15.32	11.46
66GW28	05/24/94	6.5 - 16.5	21.10	8.56	12.54
66GW30	05/24/94	7 - 17	23.06	12.31	10.75
66GW34	12/11/02	8 - 18	24.00	11.96	12.04
66GW35	05/29/94	8 - 18	22.93	10.76	12.17
66GW36	05/24/94	7 - 17	24.91	13.07	11.84
66GW37	05/20/94	8 - 18	24.15	11.76	12.39
66GW47	05/26/94	8 - 18	22.09	12.51	9.58
66GW49	05/26/94	7 - 17	21.44	10.21	11.23
72GW02	01/18/95	4 - 14	26.52	8.89	17.63
72GW04	01/18/95	5 - 15	25.72	not measured	--
72GW06	01/31/95	6 - 16	27.99	13.14	14.85
72GW09	02/08/95	5 - 15	26.73	11.89	14.84
72GW10	02/08/95	5 - 15	27.06	11.69	15.37
72GW14	02/09/95	5 - 15	24.72	8.69	16.03
72GW15	02/08/95	5 - 15	26.53	10.50	16.03
72GW18	07/26/95	6 - 16	25.79	11.11	14.68
72GW21	07/26/95	5 - 15	26.26	11.66	14.60
72GW26	07/19/95	4 - 14	26.60	7.63	18.97
72GW28	07/25/95	5 - 15	26.00	7.57	18.43
72GW33	07/20/95	3 - 13	23.54	7.37	16.17
72GW36	03/26/96	4 - 14	22.44	8.83	13.61
72GW37	04/01/96	5 - 15	24.89	10.97	13.92
72GW38	04/04/96	4 - 14	21.34	9.35	11.99
72GW44	06/05/96	5 - 15	23.72	13.69	10.03
72GW45	06/05/96	5 - 15	NA	NM	NA
72GW46	06/05/96	5 - 15	NA	11.62	NA
72GW48	10/01/02	5 - 25	NA	9.19	NA
90GW01	02/15/05	14.8 - 24.8	28.64	12.99	15.65
90GW02	02/15/05	15 - 25	27.97	12.76	15.21
90GW03	02/16/05	15 - 25	26.29	11.42	14.87
90GW04	02/21/05	15 - 25	24.62	13.06	11.56
90GW05	02/23/05	15 - 25	21.71	10.84	10.87
90GW06	02/23/05	15 - 25	21.40	11.55	9.85

Table 3-3
Monitoring Well Information and Groundwater Elevation Data
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station ID	Installation Date	Screen Depth (ft bgs)	Top of Casing Elevation (ft msl)	April 2005	
				Depth To Water (ft below top of casing)	Groundwater Elevation (ft msl)
90GW07	02/21/05	10 - 20	16.53	8.50	8.03
90GW08	02/21/05	5 - 15	13.95	7.14	6.81
Lower Surficial Aquifer					
OU1-MW62	07/13/00	29 - 39	26.83	11.51	15.32
13GW11	10/24/90	35 - 40	23.77	11.14	12.63
13GW143	06/11/02	45 - 50	22.03	8.48	13.55
13GW144	06/11/02	45 - 50	21.78	7.79	13.99
13GW29	12/13/91	37 - 42	24.86	12.27	12.59
56GW07	12/13/91	34 - 44	23.35	13.50	11.61*
56GW09	12/17/91	29.5 - 39.5	21.52	11.58	9.94
56GW12	12/18/91	35 - 45	27.37	17.41	9.96
66GW13	09/22/93	39 - 44	22.24	12.04	10.20
66GW14	09/23/93	39 - 44	22.11	11.54	10.57
66GW29	05/17/94	40 - 45	25.88	12.68	13.20
66GW33	12/11/02	42 - 47	24.08	11.58	12.50
66GW46	05/19/94	37 - 42	22.16	12.57	9.59
72GW07	02/08/95	31 - 36	28.30	13.25	15.05
72GW12	02/03/95	32 - 37	25.62	10.92	14.70
72GW19	08/07/95	44.5 - 49.5	25.82	11.29	14.53
72GW20	08/15/95	37 - 42	26.93	11.99	14.94
72GW24	08/22/95	45 - 50	27.03	11.94	15.09
72GW25	08/23/95	35 - 40	26.46	11.45	15.01
72GW27	08/24/95	33 - 38	26.70	10.85	15.85
72GW29	08/14/95	31 - 36	26.13	NM	NA
72GW41	04/04/96	40 - 45	21.16	12.56	8.60
72GW43	06/05/96	39 - 44	23.59	11.71	11.88
74GW01	10/07/94	30.5 - 35.5	24.23	not measured	--
90GW09	02/19/05	46 - 56	23.07	12.02	11.05
90GW10	02/23/05	45 - 55	24.62	13.31	11.31
90GW11	02/25/05	40 - 50	23.23	10.99	12.24
90GW12	02/18/05	46 - 56	25.24	10.88	14.36
90GW13	02/17/05	48 - 58	23.04	11.03	12.01
90GW14	02/25/05	30 - 40	23.17	12.81	10.36
90GW15	02/22/05	38 - 48	21.15	11.65	9.50
90GW16	02/22/05	36 - 46	21.23	11.54	9.69
Yorktown Aquifer					
90GW17	02/26/05	117 - 127	21.75	18.03	3.72
90GW18	02/27/05	88.5 - 98.5	23.57	16.48	7.09

Notes and Abbreviations

***** Groundwater Elevation corrected for presence of Free Product = TOC Elevation – [measured depth to water – (estimated product specific density of 0.81 x product thickness)] = 23.35 - [13.50 - (0.81 x 2.17)] = 11.61

NA - Not available

ft bgs - feet below ground surface ft msl - feet above mean sea level

Table 3-4
Phase II RI (October 2003) Groundwater Field-Measured Data
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station ID	OU1-MW61	OU1-MW62	13GW05	13GW11	13GW12	13GW120A	13GW135	13GW143	13GW144	13GW17	13GW19	13GW20
Sample ID	OU1-MW61-03D	OU1-MW62-03D	OU14-13GW05-03D	OU14-13GW11-03D	OU14-13GW12-03D	OU14-13GW120A-03D	OU14-13GW135-03D	OU14-13GW143-03D	OU14-13GW144-03D	OU14-13GW17-03D	OU14-13GW19-03D	OU14-13GW20-03D
Sample Date	10/22/2003	10/22/2003	10/23/2003	10/28/2003	10/30/2003	10/28/2003	10/24/2003	10/28/2003	10/29/2003	10/28/2003	10/28/2003	10/28/2003
Dissolved Oxygen (mg/L)	0.34	0	0.27	0	0	0	0.38	0	0	0	0.31	0
Oxidation Reduction Potential (mV	-49	-170	-26	59	-172	64	-147	-9	-12	3	-100	-10
pH (standard units)	5.7	6.5	5.5	5.4	4.7	4.5	4.8	5.3	5.2	5.0	4.9	5.9
Salinity (percent)	0.01	0.17	0.01	0.01	0	0.02	0	0	0	0.01	0.01	0.01
Specific Conductance (mS/cm)	0.25	3.38	0.35	0.15	0.02	0.41	0.10	0.13	0.11	0.18	0.17	0.33
Temperature (°C)	25.4	22.6	21.8	23	24.6	22.4	24.4	20.7	20.7	24.7	23.5	24.9
Turbidity (NTU)	0	280	4	126	60	44	40	60	172	62	30	42

Station ID	13GW29	56GW02	56GW06	56GW07	56GW09	56GW12	56GW13	56GW23	66GW05	66GW06	66GW07	66GW10
Sample ID	OU14-13GW29-03D	OU14-56GW02-03D	OU14-56GW06-03D	OU14-56GW07-03D	OU14-56GW09-03D	OU14-56GW12-03D	OU14-56GW13-03D	OU14-56GW23-03D	OU14-66GW05-03D	OU14-66GW06-03D	OU14-66GW07-03D	OU14-66GW10-03D
Sample Date	10/24/2003	10/29/2003	10/27/2003	10/29/2003	10/24/2003	10/27/2003	10/24/2003	10/28/2003	10/30/2003	10/30/2003	10/30/2003	10/29/2003
Dissolved Oxygen (mg/L)	0	0	2.39	0	0	0.47	0.24	0.29	0	0	3.94	0.08
Oxidation Reduction Potential (mV	-2	-182	304	-137	39	76	-158	187	-131	-252	-3	-1
pH (standard units)	5.5	4.3	4.8	5.9	5.3	5.7	6.3	5.0	6.5	6.5	6.6	6.6
Salinity (percent)	0	0	0	0.01	0.01	0.01	0.01	0.01	0	0	0	0.01
Specific Conductance (mS/cm)	0.12	0.01	0.126	0.244	0.15	0.22	0.32	0.18	0.023	0.05	0.012	0.31
Temperature (°C)	21.0	20.5	22.46	22.04	20	20.3	22.2	23	21.88	21.8	21.49	22.5
Turbidity (NTU)	138	0	103	112	48	10	95	60	93	50	54	49

Station ID	66GW13	66GW14	66GW20	66GW28	66GW29	66GW33	66GW34	66GW37	66GW46	66GW47	72GW02	72GW04
Sample ID	OU14-66GW13-03D	OU14-66GW14-03D	OU14-66GW20-03D	OU14-66GW28-03D	OU14-66GW29-03D	OU14-66GW33-03D	OU14-66GW34-03D	OU14-66GW37-03D	OU14-66GW46-03D	OU14-66GW47-03D	OU14-72GW02-03D	OU14-72GW04-03D
Sample Date	10/30/2003	10/30/2003	10/24/2003	10/29/2003	10/23/2003	10/29/2003	10/29/2003	10/29/2003	10/30/2003	10/28/2003	10/23/2003	10/22/2003
Dissolved Oxygen (mg/L)	NA	5	4.88	0	0	0	0	0	NA	0	0	0.7
Oxidation Reduction Potential (mV	40	18	251	-87	-99	-39	-20	141	39	-59	-48	-102
pH (standard units)	6.1	5.9	4.8	5.6	6.6	5.3	5.2	4.4	5.6	6	5.8	6.1
Salinity (percent)	0.01	0	0	0.01	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Specific Conductance (mS/cm)	0.33	NA	0.091	0.137	0.634	0.273	0.329	0.21	0.262	0.36	0.344	0.32
Temperature (°C)	20.3	20.04	21.85	25.13	21.37	21.6	23.74	23.7	21.12	22.78	24.35	32.09
Turbidity (NTU)	0	39	31	274	126	459	123	41	0	37	14	3

Station ID	72GW06	72GW07	72GW09	72GW10	72GW12	72GW14	72GW15	72GW18	72GW19	72GW20	72GW21	72GW24
Sample ID	OU14-72GW06-03D	OU14-72GW07-03D	OU14-72GW09-03D	OU14-72GW10-03D	OU14-72GW12-03D	OU14-72GW14-03D	OU14-72GW15-03D	OU14-72GW18-03D	OU14-72GW19-03D	OU14-72GW20-03D	OU14-72GW21-03D	OU14-72GW24-03D
Sample Date	10/23/2003	10/23/2003	10/24/2003	10/23/2003	10/22/2003	10/23/2003	10/22/2003	10/31/2003	10/31/2003	10/24/2003	10/30/2003	10/23/2003
Dissolved Oxygen (mg/L)	3.13	0.3	4.84	0.16	0	0	0	0	0	1.62	0	1.32
Oxidation Reduction Potential (mV	271	-139	157	-39	-156	105	-70	-211	-78	69	-201	-117
pH (standard units)	4.8	6.8	6.5	6.1	6.6	6.1	5.9	6.7	6.7	7.5	5.2	7.3
Salinity (percent)	0.01	0.03	0.02	0.01	0.11	0.02	0.01	0	0.03	0.01	0	0.01
Specific Conductance (mS/cm)	0.204	0.67	0.46	0.22	2.19	0.44	0.17	0.01	0.61	0.19	0.01	0.33
Temperature (°C)	26.45	23.7	25	25.8	30.5	23.38	29.8	23.4	22.5	22.4	24.9	22.6
Turbidity (NTU)	10	41	17	24	200	26	70	0	12	16	121	19

Station ID	72GW25	72GW26	72GW27	72GW28	72GW29	72GW38	72GW41	72GW43
Sample ID	OU14-72GW25-03D	OU14-72GW26-03D	OU14-72GW27-03D	OU14-72GW28-03D	OU14-72GW29-03D	OU14-72GW38-03D	OU14-72GW41-03D	OU14-72GW43-03D
Sample Date	10/23/2003	10/23/2003	10/23/2003	10/22/2003	10/22/2003	10/27/2003	10/27/2003	10/27/2003
Dissolved Oxygen (mg/L)	0.27	0.29	0	7.6	0	4.71	0	0
Oxidation Reduction Potential (mV	-154	-33	-11	115	-92	206	-55	-23
pH (standard units)	7.0	5.8	6.3	6.7	6.9	5.7	6.2	5.5
Salinity (percent)	0.02	0.01	0.02	0.04	0.01	0.01	0.01	0.01
Specific Conductance (mS/cm)	0.52	0.26	0.47	0.93	0.34	0.17	0.35	0.18
Temperature (°C)	21.1	24	22.1	24.7	23.6	22.6	21.8	22
Turbidity (NTU)	10	14	84	0	7	0	87	133

Notes and Abbreviations

Specific conductance is the electrical conductivity value standardized to 25°C (degrees Celsius)
DO - Dissolved Oxygen
ORP - Oxidation-Reduction Potential Eh ≈ ORP +200 mV.
NTU - Nephelometric Turbidity Units
mS/cm - millisiemens per centimeter; 1 Siemen = 1/ohm = mho.
mg/L - milligrams per liter
mV - millivolts

Table 3-5
Phase III RI (April 2005) Groundwater Field-Measured Data
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station ID	OU1-MW61	13GW12	13GW17	13GW21	13GW25	56GW02	66GW02	66GW03	66GW28
Sample ID	OU1-MW61-05B	OU14-13GW12-05B	OU14-13GW17-05B	OU14-13GW21-05B	OU14-13GW25-05B	OU14-56GW02-05B	OU14-66GW02-05B	OU14-66GW03-05B	OU14-66GW28-05B
Sample Date	04/21/05	04/20/05	04/20/05	04/19/05	04/20/05	04/21/05	04/19/05	04/19/05	04/15/05
Dissolved Oxygen (mg/L)	0	0	2.9	0.5	0.1	0	0	0	0
Oxidation Reduction Potential (mV)	-128	-4	-59	255	302	-119	-252	125	495
pH (standard units)	6.1	5	4.9	5.9	6.5	4.4	5.9	5.5	5.5
Salinity (percent)	0	0	0	0.01	0	0	0	0	0.01
Specific Conductance (mS/cm)	0.235	0.186	0.265	0.377	0.586	0.132	0.161	0.275	0.362
Temperature (°C)	18.4	21.2	19.3	17.7	18.4	20.2	20.7	18.6	15.6
Turbidity (NTU)	49	36	7	16	10	41	15	5	8

Station ID	66GW34	66GW35	66GW36	66GW47	66GW49	72GW10	72GW21	72GW28	90GW01
Sample ID	OU14-66GW34-03D	OU14-66GW35-05B	OU14-66GW36-05B	OU14-66GW47-03D	OU14-66GW49-05B	OU14-72GW10-05B	OU14-72GW21-05B	OU14-72GW28-05B	OU14-90GW01-05B
Sample Date	04/19/05	04/19/05	04/19/05	04/19/05	04/20/05	04/21/05	04/20/05	04/21/05	04/19/05
Dissolved Oxygen (mg/L)	0	3.7	0.34	0.26	0.12	0	0	9.66	2.33
Oxidation Reduction Potential (mV)	-37	-151	105	-56	252	456	-127	517	48
pH (standard units)	5.3	5.1	5	5.8	4.7	5.9	5.4	6.9	5.7
Salinity (percent)	0	0	0	0	0	0	0	0	0.1
Specific Conductance (mS/cm)	0.379	0.242	0.138	0.347	0.124	0.287	0.197	0.603	1.86
Temperature (°C)	19.72	20.02	16.99	16.29	18.05	18.72	21.01	17.74	22.12
Turbidity (NTU)	0	31	0	83	21	15	21	71	72

Station ID	90GW02	90GW03	90GW04	90GW05	90GW06	90GW07	90GW08	13GW11	13GW143
Sample ID	OU14-90GW02-05B	OU14-90GW03-05B	OU14-90GW04-05B	OU14-90GW05-05B	OU14-90GW06-05B	OU14-90GW07-05B	OU14-90GW08-05B	OU14-13GW11-05B	OU14-13GW143-05B
Sample Date	04/19/05	04/20/05	04/19/05	04/18/05	04/18/05	04/18/05	04/18/05	04/20/05	04/15/05
Dissolved Oxygen (mg/L)	2.9	2.1	0.9	0	0	0	0	0	0.3
Oxidation Reduction Potential (mV)	146	-320	-127	206	31	111	-87	144	334
pH (standard units)	5.7	4.6	4.8	4.6	6	5	6	5.4	5
Salinity (percent)	0	0	0	0	0	0	0	0	0
Specific Conductance (mS/cm)	0.409	0.134	0.25	0.22	0.344	0.134	0.71	0.160	0.155
Temperature (°C)	17.8	19.8	20.4	19.4	17.3	17.2	16.9	22.3	17.0
Turbidity (NTU)	38	11	76	35	0	22	65	19	6

Station ID	13GW144	13GW29	56GW09	66GW29	66GW46	72GW19	72GW27	90GW09	90GW10
Sample ID	OU14-13GW144-05B	OU14-13GW29-05B	OU14-56GW09-05B	OU14-66GW29-05B	OU14-66GW46-05B	OU14-72GW19-05B	OU14-72GW27-05B	OU14-90GW09-05B	OU14-90GW10-05B
Sample Date	04/15/05	04/21/05	04/21/05	04/21/05	04/19/05	04/20/05	04/21/05	04/20/05	04/20/05
Dissolved Oxygen (mg/L)	0	1.6	0	0.8	2.0	0	0	0	0
Oxidation Reduction Potential (mV)	391	499	-50	72	6	-70	-144	-84	350
pH (standard units)	5	5.2	5.6	6.9	5.6	6.8	6.4	6.6	6.1
Salinity (percent)	0	0	0	0	0	0	0	0	0
Specific Conductance (mS/cm)	0.114	0.121	0.205	0.568	0.261	0.746	0.467	0.562	0.358
Temperature (°C)	16.7	18.7	19.6	20.8	19.5	20.6	21.6	20.5	18.9
Turbidity (NTU)	-5	125	25	6	115	0	93	50	18

Station ID	90GW11	90GW12	90GW13	90GW14	90GW15	90GW16	90GW17	90GW17	90GW18
Sample ID	OU14-90GW11-05B	OU14-90GW12-05B	OU14-90GW13-05B	OU14-90GW14-05B	OU14-90GW15-05B	OU14-90GW16-05B	OU14-90GW17-05B	OU14-90GW17-0807	OU14-90GW18-05B
Sample Date	04/21/05	04/20/05	04/20/05	04/15/05	04/18/05	04/18/05	04/20/05	08/29/07	04/20/05
Dissolved Oxygen (mg/L)	0	0.6	0	0	0	0	0	0	0
Oxidation Reduction Potential (mV)	551	-190	-160	-214	-161	175	-219	-211	-326
pH (standard units)	6.4	6.6	5.6	6.4	6.6	6.3	9.5	7.4	7.7
Salinity (percent)	0	0.1	0	0	0	0	0	0	0
Specific Conductance (mS/cm)	0.579	1.4	0.121	0.712	0.703	0.652	0.436	0.355	0.587
Temperature (°C)	20.4	19.2	22.1	18	20.5	18.4	19.4	29.2	22.7
Turbidity (NTU)	92	140	47	16	17	47	15	28	64

Notes and Abbreviations

Specific conductance is the electrical conductivity value standardized to 25°C (degrees Celsius)
DO - Dissolved Oxygen
ORP - Oxidation-Reduction Potential Eh ≈ ORP +200 mV.
NTU - Nephelometric Turbidity Units
mS/cm - millisiemens per centimeter; 1 Siemen = 1/ohm = mho.
mg/L - milligrams per liter
mV - millivolts

Table 3-6
Phase III Groundwater Sampling Plan
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station ID	TCL VOCs	Geochemistry Suite	BOD	TOC	Methane, Ethane, & Ethene
Upper Surficial Aquifer					
13GW12	x				x
13GW17	x				
18GW21	x				
18GW25	x				
56GW02	x	x	x	x	x
66GW02	x	x	x	x	
66GW03	x				
66GW28	x				
66GW34	x	x	x	x	x
66GW35	x				
66GW36	x	x	x	x	x
66GW47	x	x	x	x	x
66GW49	x				
72GW10	x				
72GW21	x	x	x	x	x
72GW28	x				
90GW01	x	x	x	x	x
90GW02	x	x	x	x	x
90GW03	x				
90GW04	x				
90GW05	x				
90GW06	x	x	x	x	x
90GW07	x	x	x	x	x
90GW08	x				
OU1-MW61	x	x	x	x	x
Lower Surficial Aquifer					
13GW11	x	x	x	x	x
13GW143	x				
13GW144	x				
13GW29	x				
56GW09	x	x	x	x	x
66GW29	x				
66GW46	x				
72GW19	x	x	x	x	x
72GW27	x	x	x	x	x
90GW09	x	x	x	x	x
90GW10	x				
90GW11	x				
90GW12	x	x	x	x	x
90GW13	x	x	x	x	x
90GW14	x				
90GW15	x				
90GW16	x	x	x	x	x
Yorktown Aquifer					
90GW17 *	x				
90GW18	x				

Notes and Abbreviations

***** Yorktown Aquifer monitoring well OU14-90GW17 was re-sampled in August 2007 for low concentration TCL VOCs

● Geochemistry Suite: Nitrate, Nitrite, Iron, Manganese, Sulfide, Sulfate, and Chloride

BOD - Biological Oxygen Demand
TOC - Total Organic Carbon
TCL - Target Compound List
VOCs - Volatile Organic Compounds

Laboratory Methods

Chloride (325.1/ 325.3)
Chloride (325.1/ 325.3)
Iron and Manganese – 6010B
Methane, ethane and ethene - RSK 175
Nitrate/Nitrite (353.3/ 354.1)
Sulfate (375.4)
Sulfide (376.1/ 9030)
Total Organic Carbon (TOC) (415.2/ 9060)
TCL VOC - SW-846 8260B
TCL Low Concentration VOC - CLP OLC03.2 (August 2007 90GW17 groundwater sample)

Table 3-7
Phase III Surface Water Field-Measured Data
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station ID	OU14-SW01	OU14-SW02	OU14-SW03	OU14-SW04	OU14-SW05	OU14-SW06
Sample ID	OU14-SW01-0406	OU14-SW02-0406	OU14-SW03-0406	OU14-SW04-0406	OU14-SW05-0406	OU14-SW06-0406
Sample Date	4/25/2006	4/25/2006	4/25/2006	4/25/2006	4/25/2006	4/25/2006
Dissolved Oxygen (mg/L)	10.1	11.5	11.5	11.5	10.9	8.9
Oxidation Reduction Potential (mV)	84	150	86	32	258	298
Eh (mV)	284	350	286	232	458	498
pH (standard units)	6.8	6.9	6.5	6.4	6.2	4.0
Salinity (percent)	0.01	0.01	0.01	0.01	0.01	0.23
Specific Conductance (mS/cm)	0.29	0.31	0.3	0.3	0.28	4.49
Temperature (°C)	28	26.4	24	23.9	21.3	26.1
Turbidity (NTU)	0	17	15	25	19	0

Notes and Abbreviations

Specific conductance is the electrical conductivity value standardized to 25°C (degrees Celsius)
DO - Dissolved Oxygen
ORP - Oxidation-Reduction Potential Eh ≈ ORP +200 mV.
NTU - Nephelometric Turbidity Units
mS/cm - millisiemens per centimeter; 1 Siemen = 1/ohm = mho.
mg/L - milligrams per liter
mV - millivolts

TABLE 4-1
Generalized Relationship Between the Geologic and Hydrogeologic Units
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

GEOLOGIC UNITS			HYDROGEOLOGIC UNITS
System	**Series**	**Formation**	**Aquifer and Confining Unit**
Quaternary	Holocene	Undifferentiated	Surficial aquifer
	Pleistocene	Flanner Beach	
		James City	Yorktown confining unit
Tertiary	Pliocene	Yorktown	Yorktown aquifer
			Pungo River confining unit
	Miocene	Pungo River	Pungo River aquifer
			Upper Castle Hayne confining unit
	Oligocene	River Bend	Upper Castle Hayne aquifer
			Lower Castle Hayne confining unit
	Eocene	Castle Hayne Limestone	Lower Castle Hayne aquifer
			Beaufort confining unit
	Paleocene	Beaufort	Beaufort aquifer
			Peedee confining unit
Cretaceous	Upper Cretaceous	Peedee	Peedee aquifer
			Black Creek confining unit
		Black Creek and Middendorf	Black Creek aquifer
			Upper Cape Fear confining unit
		Cape Fear	Upper Cape Fear aquifer
			Lower Cape Frea confining unit
			Lower Cape Fear aquifer
Pre-Cretaceous crystalline basement rocks			

Source: *Application of Geophysical Mehods to the Delineation of Paleochannels and Missing Confining Units above the Castle Hayne Aquifer at U.S. Marine Corps Air Station, Cherry Point, North Carolina,* Daniel, C.C., III, Miller, R.D., and Wredge, B.M., USGS WRIR 9504252, 1995.

TABLE 4-2
Summary of Water Usage in Capacity Use Area #1 (MGD)
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Type of Use	Permitted Groundwater Withdrawls (MGD)	Actual Groundwater Withdrawls (MGD)	Permitted Surface Water Withdrawls (MGD)	Actual Surface Water Withdrawls (MGD)
Industrial	6.3	1.9	147.6	75.5
Irrigation Agriculture	14.6	0.45	1.2	-
Mine Dewatering	86	11.8	-	-
Public Supply	28.5	10.5	0.36	-
Aquaculture	22.7	0.7	0.9	0.1

Notes and Abbreviations
MGD - Million gallons per day
Source: *Annual Status Report Capacity Use Area #1* , Division of Water Resources, North Carolina Department of Natural Resources, 1999.
Groundwater withdrawels reported for the Castle Hayne Aquifer.

TABLE 4-3
Slug Test Results
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Monitoring Well	Slug Test Type	Slug Test Analytical Method	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (ft/day)	Saturated Thickness (ft)	Transmissivity (ft^2/day)
Upper Surficial Aquifer						
74GW23	Rising Head	Bouwer-Rice	0.0044	12	40	493
90GW01	Falling Head	Bouwer-Rice	0.0051	14	37	533
90GW01	Rising Head	Bouwer-Rice	0.0061	17	37	640
90GW04*	Rising Head	Bouwer-Rice	0.0461	131	37	4,830
90GW06**	Falling Head	Bouwer-Rice	0.0224	63	37	2,349
90GW06**	Rising Head	Bouwer-Rice	0.0377	107	37	3,951
Geometric Mean			***0.0052***	***15***		***552***
Standard Deviation			***0.0009***	***2***		***76***
Lower Surficial Aquifer						
74GW22	Rising Head	Bouwer-Rice	0.0018	5	41	213
74GW24	Rising Head	Bouwer-Rice	0.0118	34	40	1,340
90GW10	Rising Head	Bouwer-Rice	0.0036	10	42	428
90GW14	Rising Head	Bouwer-Rice	0.0019	5	28	146
90GW15	Rising Head	Bouwer-Rice	0.0021	6	36	215
Geometric Mean			***0.0032***	***9***		***329***
Standard Deviation			***0.0043***	***12***		***499***

Notes and Abbreviations

*Rising-Head Slug test results for wells 90GW04 and 90GW06 were excluded from calculations because these values are outliers in the data set.
**Falling-Head slug test result for well 90GW06 was excluded from this analysis because the well screen was not completely saturated (i.e., not completely below the water table) during the slug tests in March 2005, affecting the validity of the analysis.

ft - feet sec - second
cm - centimeter ft^2 - square feet

Table 5-1
Summary of Background Inorganic Analytical Data for Soil
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Inorganic	Frequency of Detection	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Arithmetic Mean (mg/kg)	2 Times Average Background (mg/kg)
Aluminum	21/21	488	16,900	5,081.6	10,163.2
Arsenic	13/21	0.43	13.7	1.95	3.9
Barium	20/21	1	30.9	11.5	23
Beryllium	2/21	0.24	0.59	0.22	0.44
Boron	2/4	1.6	3.1	1.45	2.9
Cadmium	1/21	1.35	1.35	0.56	1.12
Calcium	18/21	15.5	1750	255.66	511.32
Chromium	20/21	2.7	26.35	8.48	16.96
Cobalt	3/21	0.88	6.05	1.19	2.38
Copper	12/21	0.82	8.15	1.88	3.76
Cyanide	1/15	0.57	0.57	0.31	0.62
Iron	21/21	573	9,055	2,979.4	5,958.8
Lead	20/21	0.93	14.9	5.26	10.52
Magnesium	20/21	27.1	871	210.87	421.74
Manganese	20/21	2.5	39.35	8.36	16.72
Mercury	2/17	0.15	0.235	0.06	0.12
Nickel	3/21	4.7	10.2	3.45	6.9
Potassium	16/17	41.4	957.5	240.67	481.34
Selenium	7/21	0.24	1.1	0.28	0.56
Silver	1/21	1.69	1.69	0.41	0.82
Sodium	10/17	7.3	72.3	25.53	51.06
Strontium	4/4	1.4	7.7	3.18	6.36
Thallium	1/21	0.48	0.48	0.48[a]	0.96
Vanadium	21/21	1.2	30.45	9.58	19.16
Zinc	18/21	1.3	34.65	5.66	11.32

Notes and Abbreviations

● Source: *Draft Investigation Report, MCAS Cherry Point, North Carolina,* Tetra Tech NUS, 1999.

[a] The maximum detected concentration is used because the calculated arithmetic mean is greater than the maximum detected concentration.

mg/kg - milligrams per kilogram

Table 5-2
Summary of Background Inorganic Analytical Data for Groundwater
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Inorganic	**Frequency of Detection**	**Minimum Detection (µg/L)**	**Maximum Detection (µg/L)**	**Arithmetic Mean (µg/L)**	**2X Average Background (µg/L)**
Aluminum	8/14	38	2,500	296	592
Antimony	1/14	6.5	6.5	6.5[a]	12.2
Arsenic	3/14	3.3	26.1	3.08	6.16
Barium	14/14	3	110	40.3	80.6
Calcium	12/14	1,550	86,000	35,050	70,100
Chromium	1/14	9.7	9.7	4.19	8.38
Cobalt	1/14	8.65	8.65	4.17	8.34
Copper	6/14	2	4	1.79	3.58
Iron	13/14	58.9	8,990	2,370	4,740
Lead	1/14	5	5	0.86	1.72
Magnesium	14/14	708	15,800	2,980	5,960
Manganese	14/14	5.3	101	46.7	93.4
Nickel	1/14	25	25	10.25	20.5
Potassium	11/14	653	18,300	3,380	6,760
Selenium	1/14	1.3	1.3	0.69	1.38
Sodium	14/14	1,280	61,500	11,400	22,800
Vanadium	1/14	1.85	1.85	1.85[a]	3.7
Zinc	7/14	2.5	14	6.17	12.34

Notes and Abbreviations

● Source: *Draft Investigation Report, MCAS Cherry Point, North Carolina,* Tetra Tech NUS, 1999.

[a] The maximum detected concentration is used because the calculated arithmetic mean is greater than the maximum detected concentration.

mg/kg - milligrams per kilogram

Table 5-3
Subsurface Soil Detections
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station Identification	USEPA Region 9 PRGs Residential Soil (1)	USEPA Region 9 PRGs Industrial Soil (2)	NC SSLs (3)	9006SB	9007SB	9008SB	9009SB		9021SB	9024SB	9025SB	9026SB	9027SB
Sample Identification				9006SB0203	9007SB0607	9008SB0203	9009SB0708	"New SVE" (same 7 foot sample depth as the October 2002 sample)	9021SB0506	9024SB0203	9025SB1011	9026SB0607	9027SB0607
Sample Date				10/17/02	10/18/02	10/17/02	10/17/02	09/24/08	10/21/02	10/22/02	10/22/02	10/22/02	10/22/02
Volatile Organic Compounds (µg/kg)													
1,1,2,2-Tetrachloroethane (PCA)	**410**	**930**	**0.953**	4.6 U	4.7 U	4.9 U	**3,200 J (1,2,3)**	2,270 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U
1,1,2-Trichloroethane (TCA)	**730**	**1,600**	**17**	4.6 U	4.7 U	4.9 U	**2,500 J (1,2,3)**	2,270 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U
1,2-Dibromo-3-chloropropane	**450**	**2,000**	**0.15**	4.6 U	4.7 U	4.9 U	**3,900 J (1,2,3)**	11,400 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U
2-Butanone	22,000,000	113,000,000	17,100	**8.5 J**	9.5 U	**10**	**5,800 J**	56,800 U	9.6 U	9.8 U	15 U	11 UJ	12 U
2-Hexanone	none	none	none	9.2 U	9.5 U	9.8 U	**19,000**	11,400 U	9.6 U	9.8 U	15 U	11 UJ	12 U
4-Methyl-2-pentanone (MIBK)	5,300,000	47,000,000	**8,125****	9.2 U	9.5 U	9.8 U	**53,000 (3)**	11,400 U	9.6 U	9.8 U	15 U	11 UJ	12 U
Acetone	14,000,000	54,000,000	**2,810****	**48**	9.5 U	**51**	**25,000 (3)**	56,800 U	9.6 U	**49**	15 U	**72 J**	**34 J**
Benzene	**600****	**1,300****	**5.62****	4.6 U	4.7 U	4.9 U	**8,000 (1,2,3)**	2,270 U	4.8 U	**5.1**	**210 (3)**	**43 J (3)**	6.1 U
Bromodichloromethane	**820****	**1,800****	**2.92****	4.6 U	4.7 U	4.9 U	**3,200 J (1,2,3)**	2,270 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U
Carbon disulfide	360,000	720,000	4,940	4.6 U	4.7 U	4.9 U	6,200 U	Not analyzed	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U
Chloroform	221	470	372	4.6 U	4.7 U	4.9 U	6,200 U	2,270 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U
Chloromethane	47,000	156,000	20	9.2 U	9.5 U	9.8 U	12,000 U	2,270 U	**3.6 J**	**4.7 J**	**7.7 J**	**8.5 J**	12 U
cis-1,2-Dichloroethene (DCE)	43,000	150,000	350	4.6 U	4.7 U	4.9 U	6,200 U	2,270 U	4.8 U	4.9 U	**7.2 J**	5.5 UJ	6.1 U
Cumene (isopropylbenzene)	570,000	2,000,000	**1,680**	4.6 U	4.7 U	4.9 U	**8,400 (3)**	2,270 U	4.8 U	**190**	**32**	**550 J**	**200 J**
Cyclohexane	**140,000****	**140,000****	none	4.6 U	4.7 U	**11**	**520,000 (1,2)**	2,270 U	**83 J**	**260 J**	7.3 U	**520 J**	6.1 U
Dichlorodifluoromethane (Freon-12)	94,000	310,000	306,000	4.6 U	4.7 U	4.9 U	6,200 U	11,400 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U
Ethylbenzene	395,000	395,000	**4,570**	4.6 U	4.7 U	**1.9 J**	**56,000 (3)**	**5,180 (3)**	4.8 U	**520 J**	**300 J**	**1,800 J**	**1,600 J**
Methyl acetate	22,000,000	92,000,000	none	4.6 U	4.7 U	4.9 U	**800,000**	Not analyzed	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U
Methylcyclohexane	2,600,000	8,700,000	none	4.6 U	4.7 U	**21**	**46,000**	Not analyzed	**58 J**	**1,700 J**	**900 J**	**2,000 J**	NA
Methylene chloride	9,100	21,000	22	9.2 U	9.5 U	9.8 U	12,000 U	11,400 U	9.6 U	9.8 U	15 U	11 U	12 U
Styrene	1,700,000	1,700,000	2,240	4.6 U	4.7 U	4.9 U	6,200 U	2,270 U	4.8 U	4.9 U	7.3 U	**36 J**	6.1 U
Toluene	520,000	520,000	7,270	4.6 U	4.7 U	4.9 U	6,200 U	2,270 U	4.8 U	4.9 U	**8.1**	**560 J**	**4.5 J**
Xylene, total	270,000	420,000	**4,960**	**2 J**	**4.6 J**	**6.1**	**160,000 (3)**	**14,000 (3)**	**3.9 J**	**610 J**	**160**	**1,900 J**	**1,400 J**

Notes and Abbreviations

- Bold value indicates detection
- The highest detected value (or lowest detection limit for nondetect) was selected for parent/duplicate sample pairs.
- Each screening criteria has been assigned a reference number listed in parentheses in the column header. The reference number is used to identify specific criteria exceeded in a particular sample. Refer to Section 5.1.4 for discussion of screening criteria.
- **Detections that exceed one or more screening values are indicated by bold red font.**

****** Note: Detections and exceedances of screening values and criteria for these chemicals and compounds occurred in the subsurface soil sample at 9009SB (7 feet below grade) in 2002. However, only ethylbenzene and xylenes were detected (and exceeded NC SSLs) when the location was re-sampled in September 2008 (7 feet below grade --- same sample depth).

- PRGs - Preliminary Remediation Goals
- NC SSLs - North Carolina Soil Screening Levels

µg/kg - micrograms per kilogram U - Analyte not detected
NA - Not analyzed J - Reported value is estimated

Table 5-3
Subsurface Soil Detections
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station Identification	USEPA Region 9 PRGs Residential Soil (1)	USEPA Region 9 PRGs Industrial Soil (2)	NC SSLs (3)	OU14-SB01	OU14-SB02	OU14-SB03	OU14-SB04	OU14-SB05	OU14-SB06	OU14-SB08	OU14-SB09	OU14-SB10	OU14-SB11
Sample Identification				OU14-SB01-1012-05A	OU14-SB02-1012-05A	OU14-SB03-1517-05A	OU14-SB04-1012-05A	OU14-SB05-1517-05A	OU14-SB06-2022-05A	OU14-SB08-0507-05A	OU14-SB09-0911-05A	OU14-SB10-2325-05A	OU14-SB11-2830-05A
Sample Date				02/15/05	02/15/05	02/15/05	02/21/05	02/23/05	02/23/05	02/21/05	02/18/05	02/23/05	02/25/05
Volatile Organic Compounds (µg/kg)													
1,1,2,2-Tetrachloroethane (PCA)	**410**	**930**	**0.953**	7.5 U	6 U	7.5 U	290 U	5.7 U	6.4 U	4.6 U	280 U	4.9 U	5.2 U
1,1,2-Trichloroethane (TCA)	**730**	**1,600**	**17**	7.5 U	6 U	7.5 U	290 U	5.7 U	6.4 U	4.6 U	280 U	4.9 U	5.2 U
1,2-Dibromo-3-chloropropane	**450**	**2,000**	**0.15**	7.5 U	6 U	7.5 U	290 U	5.7 U	6.4 U	4.6 U	280 U	4.9 U	5.2 U
2-Butanone	22,000,000	113,000,000	17,100	**33**	**21**	**11 J**	730 U	14 U	**8.4 J**	14 U	710 U	12 U	13 U
2-Hexanone	none	none	none	19 U	15 U	19 U	730 U	14 U	16 U	11 U	710 U	12 U	13 U
4-Methyl-2-pentanone (MIBK)	5,300,000	47,000,000	**8,125****	19 U	15 U	19 U	730 U	14 U	16 U	11 U	710 U	12 U	13 U
Acetone	14,000,000	54,000,000	**2,810****	**99**	**100**	**34**	730 U	**18**	**22**	**22**	710 U	**22**	**22**
Benzene	**600****	**1,300****	**5.62****	7.5 U	6 U	7.5 U	290 U	5.7 U	6.4 U	4.6 U	280 U	4.9 U	5.2 U
Bromodichloromethane	**820****	**1,800****	**2.92****	7.5 U	6 U	7.5 U	290 U	5.7 U	6.4 U	4.6 U	280 U	4.9 U	5.2 U
Carbon disulfide	360,000	720,000	4,940	**28**	**12**	**12**	290 U	5.7 U	6.4 U	4.6 U	280 U	4.9 U	**25**
Chloroform	221	470	372	7.5 U	6 U	7.5 U	290 U	**6.2**	**4.8 J**	4.6 U	280 U	4.9 U	**3.2 J**
Chloromethane	47,000	156,000	20	7.5 U	6 U	7.5 U	290 U	5.7 U	6.4 U	4.6 U	280 U	4.9 U	5.2 U
cis-1,2-Dichloroethene (DCE)	43,000	150,000	350	7.5 U	6 U	7.5 U	290 U	5.7 U	6.4 U	4.6 U	280 U	4.9 U	5.2 U
Cumene (isopropylbenzene)	570,000	2,000,000	**1,680**	7.5 U	6 U	7.5 U	**320 J**	5.7 U	6.4 U	4.6 U	**1,100**	4.9 U	5.2 U
Cyclohexane	**140,000****	**140,000****	none	7.5 U	6 U	7.5 U	290 U	5.7 U	6.4 U	4.6 U	280 U	4.9 U	5.2 U
Dichlorodifluoromethane (Freon-12)	94,000	310,000	306,000	7.5 U	6 U	**6.1 J**	290 U	5.7 U	6.4 U	4.6 U	280 U	4.9 U	5.2 U
Ethylbenzene	395,000	395,000	**4,570**	7.5 U	6 U	7.5 U	290 U	5.7 U	6.4 U	4.6 U	**740**	4.9 U	5.2 U
Methyl acetate	22,000,000	92,000,000	none	7.5 U	6 U	7.5 U	290 U	5.7 U	6.4 U	4.6 U	280 U	4.9 U	5.2 U
Methylcyclohexane	2,600,000	8,700,000	none	7.5 U	6 U	7.5 U	**820**	5.7 U	6.4 U	4.6 U	**170 J**	4.9 U	5.2 U
Methylene chloride	9,100	21,000	22	**1.9 J**	**1.4 J**	**1.7 J**	290 U	5.7 U	6.4 U	4.6 U	280 U	4.9 U	5.2 U
Styrene	1,700,000	1,700,000	2,240	7.5 U	6 U	7.5 U	290 U	5.7 U	6.4 U	4.6 U	280 U	4.9 U	5.2 U
Toluene	520,000	520,000	7,270	7.5 U	6 U	7.5 U	290 U	5.7 U	6.4 U	4.6 U	280 U	4.9 U	5.2 U
Xylene, total	270,000	420,000	**4,960**	23 U	18 U	23 U	**220 J**	17 U	19 U	14 U	**1,300**	15 U	16 U

Notes and Abbreviations

- Bold value indicates detection
- The highest detected value (or lowest detection limit for nondetect) was selected for parent/duplicate sample pairs.
- Each screening criteria has been assigned a reference number listed in parentheses in the column header. The reference number is used to identify specific criteria exceeded in a particular sample. Refer to Section 5.1.4 for discussion of screening criteria.
- **Detections that exceed one or more screening values are indicated by bold red font.**

****** Note: Detections and exceedances of screening values and criteria for these chemicals and compounds occurred in the subsurface soil sample at 9009SB (7 feet below grade) in 2002. However, only ethylbenzene and xylenes were detected (and exceeded NC SSLs) when the location was re-sampled in September 2008 (7 feet below grade --- same sample depth).

- PRGs - Preliminary Remediation Goals
- NC SSLs - North Carolina Soil Screening Levels

µg/kg - micrograms per kilogram U - Analyte not detected
NA - Not analyzed J - Reported value is estimated

Station Identification	USEPA Region 9 PRGs Residential Soil (1)	USEPA Region 9 PRGs Industrial Soil (2)	NC SSLs (3)	OU14-SB12	OU14-SB13	OU14-SB14	OU14-SB15	OU14-SB16
Sample Identification				OU14-SB12-4951-05A	OU14-SB13-1012-05A[1]	OU14-SB14-0305-05A	OU14-SB15-1315-05A	OU14-SB16-3335-05A
Sample Date				02/18/05	02/16/05	02/25/05	02/22/05	02/22/05
Volatile Organic Compounds (µg/kg)								
1,1,2,2-Tetrachloroethane (PCA)	**410**	**930**	**0.953**	3.4 U	6.6 U	5.2 U	5.2 U	5.8 U
1,1,2-Trichloroethane (TCA)	**730**	**1,600**	**17**	3.4 U	6.6 U	5.2 U	5.2 U	5.8 U
1,2-Dibromo-3-chloropropane	**450**	**2,000**	**0.15**	3.4 U	6.6 U	5.2 U	5.2 U	5.8 U
2-Butanone	22,000,000	113,000,000	17,100	**15**	**18**	**24 J**	**11 J**	**23 J**
2-Hexanone	none	none	none	8.5 U	16 U	13 U	13 U	15 U
4-Methyl-2-pentanone (MIBK)	5,300,000	47,000,000	**8,125****	8.5 U	16 U	13 U	13 U	15 U
Acetone	14,000,000	54,000,000	**2,810****	**31**	**46**	**160 J**	**21**	**29**
Benzene	**600****	**1,300****	**5.62****	3.4 U	6.6 U	5.2 U	**1.3 J**	**0.94 J**
Bromodichloromethane	**820****	**1,800****	**2.92****	3.4 U	6.6 U	5.2 U	5.2 U	5.8 U
Carbon disulfide	360,000	720,000	4,940	**6.4**	**12**	**1.8 J**	5.2 U	**5 J**
Chloroform	221	470	372	3.4 U	6.6 U	5.2 U	**1.5 J**	**1.6 J**
Chloromethane	47,000	156,000	20	3.4 U	6.6 U	5.2 U	5.2 U	5.8 U
cis-1,2-Dichloroethene (DCE)	43,000	150,000	350	3.4 U	6.6 U	5.2 U	5.2 U	5.8 U
Cumene (isopropylbenzene)	570,000	2,000,000	**1,680**	3.4 U	6.6 U	5.2 U	5.2 U	5.8 U
Cyclohexane	**140,000****	**140,000****	none	3.4 U	6.6 U	5.2 U	5.2 U	5.8 U
Dichlorodifluoromethane (Freon-12)	94,000	310,000	306,000	3.4 U	**2.5 J**	5.2 U	5.2 U	**1.4 J**
Ethylbenzene	395,000	395,000	**4,570**	3.4 U	6.6 U	5.2 U	5.2 U	5.8 U
Methyl acetate	22,000,000	92,000,000	none	3.4 U	6.6 U	5.2 U	5.2 U	5.8 U
Methylcyclohexane	2,600,000	8,700,000	none	3.4 U	6.6 U	5.2 U	5.2 U	5.8 U
Methylene chloride	9,100	21,000	22	3.4 U	**1.5 J**	5.2 U	5.2 U	5.8 U
Styrene	1,700,000	1,700,000	2,240	3.4 U	6.6 U	5.2 U	5.2 U	5.8 U
Toluene	520,000	520,000	7,270	3.4 U	6.6 U	5.2 U	5.2 U	5.8 U
Xylene, total	270,000	420,000	**4,960**	10 U	20 U	**33 J**	15 U	17 U

Notes and Abbreviations

- Bold value indicates detection
- The highest detected value (or lowest detection limit for nondetect) was selected for parent/duplicate sample pairs.
- Each screening criteria has been assigned a reference number listed in parentheses in the column header. The reference number is used to identify specific criteria exceeded in a particular sample. Refer to Section 5.1.4 for discussion of screening criteria.
- **Detections that exceed one or more screening values are indicated by bold red font.**

****** Note: Detections and exceedances of screening values and criteria for these chemicals and compounds occurred in the subsurface soil sample at 9009SB (7 feet below grade) in 2002. However, only ethylbenzene and xylenes were detected (and exceeded NC SSLs) when the location was re-sampled in September 2008 (7 feet below grade --- same sample depth).

- PRGs - Preliminary Remediation Goals
- NC SSLs - North Carolina Soil Screening Levels

µg/kg - micrograms per kilogram U - Analyte not detected
NA - Not analyzed J - Reported value is estimated

Table 5-4
Upper Surficial Aquifer Groundwater Detections
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station Identification	MCL	NC2L Groundwater Standard (2)	USEPA Region 9 PRG Tap Water (3)	2 x Background (Inorganics)	OU1-MW61		OU14-13GW05	OU14-13GW12		OU14-13GW17		OU14-13GW19	OU14-13GW20	OU14-13GW21	OU14-13GW25	OU14-13GW120A	OU14-13GW135
Sample Identification					OU1-MW61-03D	OU1-MW61-05B	OU14-13GW05-03D	OU14-13GW12-03D	OU14-13GW12-05B	OU14-13GW17-03D	OU14-13GW17-05B	OU14-13GW19-03D	OU14-13GW20-03D	OU14-13GW21-05B	OU14-13GW25-05B	OU14-13GW120A-03D	OU14-13GW135-03D
Sample Date	(1)				10/22/03	04/21/05	10/23/03	10/30/03	04/20/05	10/28/03	04/20/05	10/28/03	10/28/03	04/19/05	04/20/05	10/28/03	10/24/03
Volatile Organic Compounds (µg/L)																	
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	none	210,000	59,000	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**23**	10 U
1,1-Dichloroethane	none	**70**	810	none	**170 (2)**	**19**	5 U	**8**	**46**	**1 J**	5 U	5 U	5 U	5 U	5 U	5 U	10 U
1,1-Dichloroethene	7	7	340	none	**0.3 J**	**1 J**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U
1,2,4-Trichlorobenzene	70	70	7	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U
1,2-Dichloroethane	**5**	**0.38**	**0.12**	none	**1 J (2,3)**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**1 J (2,3)**
Acetone	none	700	5,500	none	5 R	13 U	5 R	5 R	13 U	5 R	**9.1 J**	5 R	5 R	15 U	13 U	5 R	50 U
Benzene	**5**	**1**	**0.34**	none	**8 (1,2,3)**	**6.1 (1,2,3)**	5 U	5 U	5 U	**2 J (2,3)**	5 U	**0.5 J (3)**	5 U	5 U	**1.9 J (2,3)**	**1 J (3)**	**260 (1,2,3)**
Carbon disulfide	none	700	1,000	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U
Chloroethane	none	2,800	4.6	none	**4 J**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U
Chloromethane	none	**2.6**	160	none	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**3 J (2,3)**
cis-1,2-Dichloroethene	70	70	61	none	**3 J**	**3 J**	**1 J**	**6**	**20**	**8**	5 U	5 U	5 U	5 U	5 U	5 U	**3 J**
Cumene (isopropylbenzene)	none	**70**	660	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**2.3 J**	**3 J**	**1 J**	**16**
Cyclohexane	none	none	35,000	none	**6**	**1.1 J**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**14**
Dichlorodifluoromethane (Freon-12)	none	1,400	390	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**2 J**	10 U
Ethylbenzene	700	550	1,340	none	**1 J**	**2.2 J**	5 U	5 U	5 U	**1 J**	**0.53 J**	**0.5 J**	5 U	**5.5**	**0.89 J**	**2 J**	**70**
Methylcyclohexane	none	none	5,200	none	**4 J**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**9 J**
Methylene chloride	**5**	**4.6**	**4.3**	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U
Methyl-tert-butyl ether (MTBE)	none	200	**11**	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U
Tetrachloroethene (PCE)	5	**0.7**	**0.1**	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U
Toluene	1,000	1,000	720	none	**1 J**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**4 J**
trans-1,2-Dichloroethene	100	100	120	none	**1 J**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U
Trichloroethene (TCE)	**5**	**2.8**	**1.4**	none	5 U	**1 J**	5 U	**5 (2,3)**	**16 J (1,2,3)**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U
Trichlorofluoromethane (Freon-11)	none	2,100	1,300	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U
Vinyl chloride (VC)	**2**	**0.015**	**0.02**	none	**110 (1,2,3)**	**12 (1,2,3)**	5 U	**0.4 J (2,3)**	2 U	5 U	5 U	5 U	5 U	2 U	5 U	5 U	10 U
Xylene, total	10,000	**530**	**210**	none	**2 J**	5 U	15 U	15 U	5 U	**0.7 J**	5 U	15 U	15 U	5 U	5 U	15 U	**180**
Total Metals (µg/L)																	
Arsenic	**10**	**50**	**0.045**	6.2	**8.2 (3)**	NA	**3.9 J (3)**	2.13 U	NA	2.13 U	NA	**2.5 J (3)**	2.13 U	NA	NA	**4.9 J (3)**	**6 J (3)**
Barium	2,000	2,000	2,600	80.6	**82.6**	NA	**44.2**	**57.8**	NA	**65.7**	NA	**73.3**	**22**	NA	NA	**34.3**	**71**
Cadmium	5	**1.75**	18	none	**3 J (2)**	NA	0.25 U	**0.26 J**	NA	0.25 U	NA	**0.43 J**	0.25 U	NA	NA	0.25 U	**0.35 J**
Chromium	100	50	none	8.38	**1.4 J**	NA	**1 J**	0.88 U	NA	0.88 U	NA	**1.4 J**	0.88 U	NA	NA	**1.8 J**	**2.6 J**
Iron	none	**300**	**11,000**	4,740	NA	**9,730 (2)**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	15	15	none	1.7	1.56 U	NA	1.56 U	1.56 U	NA	1.56 U	NA	1.56 U	1.56 U	NA	NA	1.56 U	**4.3 J**
Manganese	none	**50**	**880**	93.4	NA	**44.8**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	2	1.05	none		0.04 U	NA	0.04 U	0.04 U	NA	0.04 UJ	NA	0.04 UJ	**0.04 J**	NA	NA	**0.05 J**	0.04 UJ
Selenium	50	50	180	1.38	**3.4 J**	NA	2.32 U	2.32 U	NA	2.32 UJ	NA	2.32 UJ	2.32 UJ	NA	NA	2.32 UJ	2.32 U
Dissolved Gases (mg/L)																	
Methane	none	none	none	none	NA	**0.24**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethane	none	none	none	none	NA	0.002 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethene	none	none	none	none	NA	**0.0003 J**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry (mg/L)																	
Chloride	none	250	none	none	NA	**11.5**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate	10	10	10	none	0.05 U	**0.15**	0.05 U	0.05 U	NA	**0.076**	NA	0.05 U	**0.11**	NA	NA	0.05 U	0.05 U
Nitrite	1	1	1	none	NA	**0.075**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	none	**250**	none	none	**11**	**26.1**	**14**	**86**	NA	**59**	NA	**57**	**83**	NA	NA	**210**	**6.5**
Sulfide	none	none	none	none	NA	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC)	none	none	none	none	NA	**9.52**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes and Abbreviations:

- Bold value indicates detection
- The highest detected value (or lowest detection limit for nondetect) was selected for parent/duplicate sample pairs.
- Each screening criteria has been assigned a reference number listed in parentheses in the column header. The reference number is used to identify specific criteria exceeded in a particular sample. Refer to Section 5.1.4 for discussion of screening criteria.
- **Detections that exceed one or more screening values are indicated by bold red font.**
- **Detections that exceed the NC2L Groundwater Standards are indicated by bold blue font (and potentially other screening values [i.e., blue font subsumes red font]).**
- Background value is two times the average background concentration as reported in Table 5-2.
- MCL - Maximum Contaminant Level (refer to Section 5.1.4)
- NC2L - 'Class GA' groundwater quality criteria as defined in the North Carolina Administrative Code, Title 15A, Chapter 2, Subchapter 2L (refer to Section 5.1.4)
- PRG - Preliminary Remediation Goal (refer to Section 5.1.4)

mg/L - milligrams per liter µg/L - micrograms per liter NA - Not Analyzed
U - Not detected above associated value R- Value rejected by data validator; unusable
J - Estimated value below practical quantitation limit, but above method detection limit

Table 5-4
Upper Surficial Aquifer Groundwater Detections
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station Identification	MCL	NC2L Groundwater Standard (2)	USEPA Region 9 PRG Tap Water (3)	2 x Background (Inorganics)	OU14-56GW02		OU14-56GW06	OU14-56GW13	OU14-56GW23	OU14-66GW02	OU14-66GW03	OU14-66GW05	OU14-66GW06	OU14-66GW07	OU14-66GW10	OU14-66GW20
Sample Identification					OU14-56GW02-03D	OU14-56GW02-05B	OU14-56GW06-03D	OU14-56GW13-03D	OU14-56GW23-03D	OU14-66GW02-05B	OU14-66GW03-05B	OU14-66GW05-03D	OU14-66GW06-03D	OU14-66GW07-03D	OU14-66GW10-03D	OU14-66GW20-03D
Sample Date	(1)				10/29/03	04/21/05	10/27/03	10/24/03	10/28/03	04/19/05	04/19/05	10/30/03	10/30/03	10/30/03	10/29/03	10/24/03
Volatile Organic Compounds (µg/L)																
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	none	210,000	59,000	none	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	none	**70**	810	none	**3 J**	**4.3 J**	5 U	25 U	**0.6 J**	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethene	7	7	340	none	5 U	**1.3 J**	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	70	70	7	none	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	**5**	**0.38**	**0.12**	none	**7 (1,2,3)**	**3.6 J (2,3)**	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	none	700	5,500	none	5 R	13 U	25 U	120 U	5 R	82 U	20 U	5 R	5 R	5 R	5 R	25 U
Benzene	**5**	**1**	**0.34**	none	**160 (1,2,3)**	**170 (1,2,3)**	5 U	**330 (1,2,3)**	**0.2 J**	5 U	5 U	5 U	5 U	5 U	5 U	**0.2 J**
Carbon disulfide	none	700	1,000	none	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	none	2,800	4.6	none	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	none	**2.6**	160	none	5 U	5 UJ	5 U	25 U	5 U	5 UJ	5.7 U	5 U	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	70	70	61	none	**24**	**30**	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Cumene (isopropylbenzene)	none	**70**	660	none	**0.5 J**	**1.1 J**	5 U	**97 (2)**	5 U	**4.2 J**	5 U	5 U	**0.3 J**	5 U	5 U	5 U
Cyclohexane	none	none	35,000	none	**7**	**14**	5 U	**460**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane (Freon-12)	none	1,400	390	none	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	700	550	1,340	none	**0.8 J**	5 U	**0.1 J**	**230**	5 U	**19**	5 U	5 U	5 U	5 U	5 U	**0.2 J**
Methylcyclohexane	none	none	5,200	none	5 U	5 U	5 U	**320**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methylene chloride	**5**	**4.6**	**4.3**	none	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl-tert-butyl ether (MTBE)	none	200	**11**	none	**2 J**	**1.6 J**	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene (PCE)	5	**0.7**	**0.1**	none	**1 J (2,3)**	5 U	**0.5 J**	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	1,000	1,000	720	none	5 U	5 U	5 U	**32**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,2-Dichloroethene	100	100	120	none	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene (TCE)	**5**	**2.8**	**1.4**	none	**150 (1,2,3)**	**180 J (1,2,3)**	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichlorofluoromethane (Freon-11)	none	2,100	1,300	none	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl chloride (VC)	**2**	**0.015**	**0.02**	none	5 U	2 U	5 U	25 U	5 U	2 U	2 U	5 U	5 U	5 U	5 U	5 U
Xylene, total	10,000	**530**	**210**	none	15 U	5 U	15 U	**960 (2,3)**	15 U	**3.6 J**	5 U	15 U	15 U	15 U	15 U	15 U
Total Metals (µg/L)																
Arsenic	**10**	**50**	**0.045**	6.2	2.13 U	NA	2.13 U	**39.3 (1,3)**	2.13 U	NA	NA	**2.8 J (3)**	**42.4 (1,3)**	2.13 U	2.13 U	**2.3 J (3)**
Barium	2,000	2,000	2,600	80.6	**49.8**	NA	**49.9**	**11.6**	**56.8**	NA	NA	**24.8**	**21.5**	**10.2**	**13.8**	**42.5**
Cadmium	5	**1.75**	18	none	0.25 U	NA	0.25 U	**0.84 J**	0.25 U	NA	NA	**0.43 J**	0.25 U	0.25 U	0.25 U	0.25 U
Chromium	100	50	none	8.38	**2.5 J**	NA	0.88 U	0.88 U	0.88 U	NA	NA	**1.9 J**	**0.93 J**	**1 J**	0.88 U	0.88 U
Iron	none	**300**	**11,000**	4,740	NA	**4,680 (2)**	NA	NA	NA	**541 (2)**	NA	NA	NA	NA	NA	NA
Lead	15	15	none	1.7	1.56 U	NA	1.56 U	**3.5 J**	1.56 U	NA	NA	**14.6**	**2.2 J**	1.56 U	1.56 U	1.56 U
Manganese	none	**50**	**880**	93.4	NA	**67.6 (2)**	NA	NA	NA	**17**	NA	NA	NA	NA	NA	NA
Mercury	2	1.05	none		**0.07 J**	NA	**0.04 J**	0.04 UJ	0.04 UJ	NA	NA	0.04 U	0.04 U	**0.05 J**	**0.07 J**	**0.05 J**
Selenium	50	50	180	1.38	**3 J**	NA	2.32 U	2.32 U	2.32 UJ	NA	NA	2.32 U	2.32 U	**3.4 J**	2.32 UJ	2.32 U
Dissolved Gases (mg/L)																
Methane	none	none	none	none	NA	**0.69**	NA	NA	NA	**0.079**	NA	NA	NA	NA	NA	NA
Ethane	none	none	none	none	NA	**0.003**	NA	NA	NA	0.002 U	NA	NA	NA	NA	NA	NA
Ethene	none	none	none	none	NA	0.002 U	NA	NA	NA	**1.00E-04 J**	NA	NA	NA	NA	NA	NA
Wet Chemistry (mg/L)																
Chloride	none	250	none	none	NA	**12.4**	NA	NA	NA	**4.15**	NA	NA	NA	NA	NA	NA
Nitrate	10	10	10	none	0.05 U	**0.435**	**0.2**	0.05 U	**0.26**	**0.025 J**	NA	**0.16**	0.05 U	**0.26**	0.05 U	**1.3**
Nitrite	1	1	1	none	NA	0.05 U	NA	NA	NA	**0.05**	NA	NA	NA	NA	NA	NA
Sulfate	none	**250**	none	none	**45**	**39**	**42**	1 U	**68**	**14.9**	NA	**16**	1 U	**7.7**	**7.6**	**25**
Sulfide	none	none	none	none	NA	1 U	NA	NA	NA	**16.8**	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC)	none	none	none	none	NA	**10.8**	NA	NA	NA	**43.1**	NA	NA	NA	NA	NA	NA

Notes and Abbreviations:

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- MCL - Maximum Contaminant Level (refer to Section 5.1.4)
- NC2L - 'Class GA' groundwater quality criteria as defined in the North Carolina Administrative Code, Title 15A, Chapter 2, Subchapter 2L (refer to Section 5.1.4)
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mg/L - milligrams per liter µg/L - micrograms per liter NA - Not Analyzed
U - Not detected above associated value R- Value rejected by data validator; unusable
J - Estimated value below practical quantitation limit, but above method detection limit

Table 5-4
Upper Surficial Aquifer Groundwater Detections
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station Identification	MCL	NC2L	USEPA Region 9	2 x	OU14-66GW28		OU14-66GW34		OU14-66GW35	OU14-66GW36	OU14-66GW37	OU14-66GW47		OU14-66GW49	OU14-72GW02	OU14-72GW04	OU14-72GW06
Sample Identification		Groundwater	PRG Tap Water	Background	OU14-66GW28-03D	OU14-66GW28-05B	OU14-66GW34-03D	OU14-66GW34-05B	OU14-66GW35-05B	OU14-66GW36-05B	OU14-66GW37-03D	OU14-66GW47-03D	OU14-66GW47-05B	OU14-66GW49-05B	OU14-72GW02-03D	OU14-72GW04-03D	OU14-72GW06-03D
Sample Date	(1)	Standard (2)	(3)	(Inorganics)	10/29/03	04/15/05	10/29/03	04/19/05	04/19/05	04/19/05	10/29/03	10/28/03	04/19/05	04/20/05	10/23/03	10/22/03	10/23/03
Volatile Organic Compounds (µg/L)																	
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	none	210,000	59,000	none	25 U	25 U	**19**	**26**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	none	**70**	810	none	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**14**	5 U
1,1-Dichloroethene	7	7	340	none	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**0.4 J**	5 U
1,2,4-Trichlorobenzene	70	70	7	none	25 U	**20 J**	5 U	5 U	5 U	**3.7 J**	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	**5**	**0.38**	**0.12**	none	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	none	700	5,500	none	25 R	63 U	5 R	13 U	13 U	13 U	5 R	5 R	13 U	13 U	5 R	5 R	5 R
Benzene	**5**	**1**	**0.34**	none	**310 (1,2,3)**	**470 (1,2,3)**	**2 J (2,3)**	5 U	**10 (1,2,3)**	**3.1 J (2,3)**	5 U	**2 J (2,3)**	**15 (1,2,3)**	5 U	5 U	**70 (1,2,3)**	5 U
Carbon disulfide	none	700	1,000	none	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	none	2,800	4.6	none	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	none	**2.6**	160	none	25 U	25 U	5 U	5 UJ	5 U	5 UJ	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	70	70	61	none	**3 J**	25 U	**3 J**	5 U	**6.5**	5 U	5 U	5 U	**3.3 J**	5 U	5 U	**2 J**	5 U
Cumene (isopropylbenzene)	none	**70**	660	none	**7 J**	25 U	**1 J**	5 U	**7.2**	**4.9 J**	5 U	5 U	5 U	5 U	5 U	**64**	5 U
Cyclohexane	none	none	35,000	none	**23 J**	**21 J**	5 U	5 U	**18**	5 U	5 U	5 U	5 U	5 U	5 U	**92**	5 U
Dichlorodifluoromethane (Freon-12)	none	1,400	390	none	25 U	25 U	5 U	5 U	5 U	5 U	**2 J**	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	700	550	1,340	none	**78**	**76**	**0.8 J**	5 U	**2.9 J**	**21**	5 U	5 U	5 U	5 U	5 U	**9**	5 U
Methylcyclohexane	none	none	5,200	none	**9 J**	25 U	5 U	5 U	**6.4**	5 U	5 U	5 U	5 U	5 U	5 U	**20**	5 U
Methylene chloride	**5**	**4.6**	**4.3**	none	**7 J (1,2,3)**	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl-tert-butyl ether (MTBE)	none	200	**11**	none	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene (PCE)	5	**0.7**	**0.1**	none	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	1,000	1,000	720	none	**65**	**98**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**0.6 J**	5 U
trans-1,2-Dichloroethene	100	100	120	none	25 U	25 U	**2 J**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene (TCE)	**5**	**2.8**	**1.4**	none	25 U	25 U	**4 J (2,3)**	**2.6 J (3)**	**19 J (1,2,3)**	5 U	5 U	**8 (1,2,3)**	**13 J (1,2,3)**	5 U	5 U	5 U	5 U
Trichlorofluoromethane (Freon-11)	none	2,100	1,300	none	25 U	25 U	5 U	5 U	5 U	5 U	**5 J**	5 U	5 U	5 U	5 U	5 U	**1 J**
Vinyl chloride (VC)	**2**	**0.015**	**0.02**	none	25 U	10 U	**0.6 J (2,3)**	2 U	2 U	2 U	5 U	5 U	2 U	5 U	5 U	**28 (1,2,3)**	5 U
Xylene, total	10,000	**530**	**210**	none	**75**	**110**	15 U	5 U	5 U	**11**	15 U	15 U	5 U	5 U	15 U	**18**	15 U
Total Metals (µg/L)																	
Arsenic	**10**	**50**	**0.045**	6.2	2.13 U	NA	2.13 U	NA	NA	NA	2.13 U	**69.9 (1,2,3)**	NA	NA	2.13 U	**40 (1,3)**	2.13 U
Barium	2,000	2,000	2,600	80.6	**23.3**	NA	**56**	NA	NA	NA	**79.3**	**35.6**	NA	NA	**100**	**64.8**	**87.1**
Cadmium	5	**1.75**	18	none	0.25 U	NA	0.25 U	NA	NA	NA	0.25 U	0.25 U	NA	NA	0.25 U	**0.28 J**	0.25 U
Chromium	100	50	none	8.38	**3.5 J**	NA	**2.6 J**	NA	NA	NA	0.88 U	**1.5 J**	NA	NA	0.88 U	**1 J**	0.88 U
Iron	none	**300**	**11,000**	4,740	NA	NA	NA	**2,760 (2)**	NA	**761 (2)**	NA	NA	**49,200 (2,3)**	NA	NA	NA	NA
Lead	15	15	none	1.7	**2.4 J**	NA	7.3	NA	NA	NA	**5**	1.56 U	NA	NA	1.56 U	1.56 U	1.8 U
Manganese	none	**50**	**880**	93.4	NA	NA	NA	**73.4 (2)**	NA	**33.5**	NA	NA	**64.8 (2)**	NA	NA	NA	NA
Mercury	2	1.05	none		0.04 UJ	NA	**0.04 J**	NA	NA	NA	0.04 UJ	**0.04 J**	NA	NA	0.04 U	0.04 U	0.04 U
Selenium	50	50	180	1.38	2.32 UJ	NA	**5.1 J**	NA	NA	NA	**2.8 J**	2.32 UJ	NA	NA	2.32 U	2.32 U	2.32 U
Dissolved Gases (mg/L)																	
Methane	none	none	none	none	NA	NA	NA	**0.034**	NA	**0.021**	NA	NA	**0.033**	NA	NA	NA	NA
Ethane	none	none	none	none	NA	NA	NA	0.002 U	NA	0.002 U	NA	NA	0.002 U	NA	NA	NA	NA
Ethene	none	none	none	none	NA	NA	NA	0.002 U	NA	0.002 U	NA	NA	0.002 U	NA	NA	NA	NA
Wet Chemistry (mg/L)																	
Chloride	none	250	none	none	NA	NA	NA	**5.28**	NA	**6.85**	NA	NA	**5.94**	NA	NA	NA	NA
Nitrate	10	10	10	none	**0.26**	NA	**0.57**	**0.335**	NA	0.05 U	**3.2**	**0.059**	0.05 U	NA	0.05 U	0.05 U	**1.6 J**
Nitrite	1	1	1	none	NA	NA	NA	0.05 U	NA	0.05 U	NA	NA	0.05 U	NA	NA	NA	NA
Sulfate	none	**250**	none	none	**38**	NA	**130**	**145**	NA	**27.8**	**83**	**92**	**64**	NA	**62 J**	**6.9**	**58**
Sulfide	none	none	none	none	NA	NA	NA	1 U	NA	**10.6**	NA	NA	1 U	NA	NA	NA	NA
Total organic carbon (TOC)	none	none	none	none	NA	NA	NA	**32.3**	NA	**8.93**	NA	NA	**18.8**	NA	NA	NA	NA

Notes and Abbreviations:

- Bold value indicates detection
- The highest detected value (or lowest detection limit for nondetect) was selected for parent/duplicate sample pairs.
- Each screening criteria has been assigned a reference number listed in parentheses in the column header. The reference number is used to identify specific criteria exceeded in a particular sample. Refer to Section 5.1.4 for discussion of screening criteria.
- **Detections that exceed one or more screening values are indicated by bold red font.**
- **Detections that exceed the NC2L Groundwater Standards are indicated by bold blue font (and potentially other screening values [i.e., blue font subsumes red font]).**
- Background value is two times the average background concentration as reported in Table 5-2.
- MCL - Maximum Contaminant Level (refer to Section 5.1.4)
- NC2L - 'Class GA' groundwater quality criteria as defined in the North Carolina Administrative Code, Title 15A, Chapter 2, Subchapter 2L (refer to Section 5.1.4)
- PRG - Preliminary Remediation Goal (refer to Section 5.1.4)

mg/L - milligrams per liter µg/L - micrograms per liter NA - Not Analyzed
U - Not detected above associated value R- Value rejected by data validator; unusable
J - Estimated value below practical quantitation limit, but above method detection limit

Table 5-4
Upper Surficial Aquifer Groundwater Detections
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station Identification	MCL	NC2L	USEPA Region 9	2 x	OU14-72GW09	OU14-72GW10		OU14-72GW14	OU14-72GW15	OU14-72GW18	OU14-72GW21		OU14-72GW26	OU14-72GW28		OU14-72GW38	OU14-90GW01
Sample Identification		Groundwater	PRG Tap Water	Background	OU14-72GW09-03D	OU14-72GW10-03D	OU14-72GW10-05B	OU14-72GW14-03D	OU14-72GW15-03D	OU14-72GW18-03D	OU14-72GW21-03D	OU14-72GW21-05B	OU14-72GW26-03D	OU14-72GW28-03D	OU14-72GW28-05B	OU14-72GW38-03D	OU14-90GW01-05B
Sample Date	(1)	Standard (2)	(3)	(Inorganics)	10/24/03	10/23/03	04/21/05	10/23/03	10/22/03	10/31/03	10/30/03	04/20/05	10/23/03	10/22/03	04/21/05	10/27/03	04/19/05
Volatile Organic Compounds (µg/L)																	
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	none	210,000	59,000	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	none	**70**	810	none	5 U	**0.4 J**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**3 J**	**2.3 J**	5 U	5 U
1,1-Dichloroethene	7	7	340	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	70	70	7	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	**5**	**0.38**	**0.12**	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	none	700	5,500	none	25 U	5 R	**3.7 J**	5 R	5 R	5 R	5 R	13 U	5 R	5 R	**6.5 J**	25 R	13 U
Benzene	**5**	**1**	**0.34**	none	5 U	**0.3 J**	5 U	5 U	**0.7 J (3)**	5 U	**1 J (2,3)**	5 U	5 U	5 U	5 U	5 U	5 U
Carbon disulfide	none	700	1,000	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	none	2,800	4.6	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	none	**2.6**	160	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ
cis-1,2-Dichloroethene	70	70	61	none	5 U	**5 J**	5 U	5 U	**0.6 J**	5 U	**3 J**	**7**	5 U	5 U	5 U	5 U	5 U
Cumene (isopropylbenzene)	none	**70**	660	none	5 U	5 U	5 U	5 U	**2 J**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Cyclohexane	none	none	35,000	none	5 U	5 U	5 U	5 U	**5 J**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane (Freon-12)	none	1,400	390	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	700	550	1,340	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methylcyclohexane	none	none	5,200	none	5 U	5 U	5 U	5 U	**3 J**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methylene chloride	**5**	**4.6**	**4.3**	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl-tert-butyl ether (MTBE)	none	200	**11**	none	5 U	5 U	5 U	5 U	5 U	5 U	**0.4 J**	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene (PCE)	5	**0.7**	**0.1**	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	1,000	1,000	720	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**30**
trans-1,2-Dichloroethene	100	100	120	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene (TCE)	**5**	**2.8**	**1.4**	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichlorofluoromethane (Freon-11)	none	2,100	1,300	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl chloride (VC)	**2**	**0.015**	**0.02**	none	5 U	5 U	2 U	5 U	5 U	5 U	**4 J (1,2,3)**	2 U	5 U	5 U	2 U	5 U	2 U
Xylene, total	10,000	**530**	**210**	none	15 U	15 U	5 U	15 U	15 U	15 U	15 U	5 U	15 U	15 U	**0.17 J**	15 U	5 U
Total Metals (µg/L)																	
Arsenic	**10**	**50**	**0.045**	6.2	2.13 U	**22.4 (1,3)**	NA	2.13 U	**3.4 J (3)**	**5.1 J (3)**	**6 J (3)**	NA	**6.6 J (3)**	2.13 U	NA	2.13 U	NA
Barium	2,000	2,000	2,600	80.6	**42.6**	**64.5**	NA	**61.4**	**31**	**12.9**	**59.7**	NA	**124**	**58.4**	NA	**41.9**	NA
Cadmium	5	**1.75**	18	none	0.25 U	0.25 U	NA	0.25 U	0.25 U	**0.39 J**	0.25 U	NA	0.25 U	0.25 U	NA	0.25 U	NA
Chromium	100	50	none	8.38	0.88 U	0.88 U	NA	0.88 U	**1.5 J**	0.88 U	**2.3 J**	NA	0.88 U	**1.6 J**	NA	0.88 U	NA
Iron	none	**300**	**11,000**	4,740	NA	NA	NA	NA	NA	NA	NA	**6,140 (2)**	NA	NA	NA	NA	**58,300 (2,3)**
Lead	15	15	none	1.7	1.56 U	1.56 U	NA	1.56 U	1.56 U	1.56 U	1.56 U	NA	1.56 U	**5.8**	NA	1.56 U	NA
Manganese	none	**50**	**880**	93.4	NA	NA	NA	NA	NA	NA	NA	**59.6 (2)**	NA	NA	NA	NA	**4,050 (2,3)**
Mercury	2	1.05	none		0.04 UJ	0.04 U	NA	**0.04 J**	0.04 U	**0.05 J**	0.04 U	NA	0.04 U	0.04 U	NA	**0.05 J**	NA
Selenium	50	50	180	1.38	2.32 U	2.32 U	NA	**3.1 J**	2.32 U	**2.8 J**	2.32 U	NA	2.32 U	2.32 U	NA	**2.3 J**	NA
Dissolved Gases (mg/L)																	
Methane	none	none	none	none	NA	NA	NA	NA	NA	NA	NA	**0.14**	NA	NA	NA	NA	**0.052**
Ethane	none	none	none	none	NA	NA	NA	NA	NA	NA	NA	0.002 U	NA	NA	NA	NA	**6.00E-04 J**
Ethene	none	none	none	none	NA	NA	NA	NA	NA	NA	NA	**8.00E-05 J**	NA	NA	NA	NA	**7.00E-05 J**
Wet Chemistry (mg/L)																	
Chloride	none	250	none	none	NA	NA	NA	NA	NA	NA	NA	**3.83**	NA	NA	NA	NA	**8.48**
Nitrate	10	10	10	none	**0.86**	0.05 U	NA	**0.42 J**	0.05 U	**0.1**	0.05 U	0.05 U	0.05 U	**1.9 J**	NA	**0.74**	**0.835**
Nitrite	1	1	1	none	NA	NA	NA	NA	NA	NA	NA	**0.05**	NA	NA	NA	NA	0.05 U
Sulfate	none	**250**	none	none	**36**	**27**	NA	**57**	**11**	**120**	**25**	**38.7**	**29**	**260 (2)**	NA	**39**	**1,630 (2)**
Sulfide	none	none	none	none	NA	NA	NA	NA	NA	NA	NA	1 U	NA	NA	NA	NA	1 U
Total organic carbon (TOC)	none	none	none	none	NA	NA	NA	NA	NA	NA	NA	**7.34**	NA	NA	NA	NA	10

Notes and Abbreviations:

- Bold value indicates detection
- The highest detected value (or lowest detection limit for nondetect) was selected for parent/duplicate sample pairs.
- Each screening criteria has been assigned a reference number listed in parentheses in the column header. The reference number is used to identify specific criteria exceeded in a particular sample. Refer to Section 5.1.4 for discussion of screening criteria.
- **Detections that exceed one or more screening values are indicated by bold red font.**
- **Detections that exceed the NC2L Groundwater Standards are indicated by bold blue font (and potentially other screening values [i.e., blue font subsumes red font]).**
- Background value is two times the average background concentration as reported in Table 5-2.
- MCL - Maximum Contaminant Level (refer to Section 5.1.4)
- NC2L - 'Class GA' groundwater quality criteria as defined in the North Carolina Administrative Code, Title 15A, Chapter 2, Subchapter 2L (refer to Section 5.1.4)
- PRG - Preliminary Remediation Goal (refer to Section 5.1.4)

mg/L - milligrams per liter µg/L - micrograms per liter NA - Not Analyzed
U - Not detected above associated value R- Value rejected by data validator; unusable
J - Estimated value below practical quantitation limit, but above method detection limit

Table 5-4
Upper Surficial Aquifer Groundwater Detections
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station Identification	MCL	NC2L	USEPA Region 9	2 x	OU14-90GW02	OU14-90GW03	OU14-90GW04	OU14-90GW05	OU14-90GW06	OU14-90GW07	OU14-90GW08
Sample Identification		Groundwater	PRG Tap Water	Background	OU14-90GW02-05B	OU14-90GW03-05B	OU14-90GW04-05B	OU14-90GW05-05B	OU14-90GW06-05B	OU14-90GW07-05B	OU14-90GW08-05B
Sample Date	(1)	Standard (2)	(3)	(Inorganics)	04/19/05	04/20/05	04/19/05	04/18/05	04/18/05	04/18/05	04/18/05
Volatile Organic Compounds (µg/L)											
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	none	210,000	59,000	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	none	**70**	810	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethene	7	7	340	none	5 U	5 U	**1.1 J**	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	70	70	7	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	**5**	**0.38**	**0.12**	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	none	700	5,500	none	13 U	13 U	13 U	13 U	13 U	13 U	13 U
Benzene	**5**	**1**	**0.34**	none	5 U	5 U	**21 (1,2,3)**	5 U	**26 (1,2,3)**	5 U	5 U
Carbon disulfide	none	700	1,000	none	5 U	5 U	**1.2 J**	5 U	5 U	5 U	5 U
Chloroethane	none	2,800	4.6	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	none	**2.6**	160	none	5 UJ	5 U	5 U	5 U	5 UJ	5 UJ	5 U
cis-1,2-Dichloroethene	70	70	61	none	**9.4**	**9.4**	**11**	5 U	5 U	5 U	5 U
Cumene (isopropylbenzene)	none	**70**	660	none	5 U	5 U	**2.4 J**	5 U	5 U	5 U	5 U
Cyclohexane	none	none	35,000	none	5 U	5 U	**10**	5 U	5 U	5 U	5 U
Dichlorodifluoromethane (Freon-12)	none	1,400	390	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	700	550	1,340	none	5 U	5 U	**8.6**	5 U	5 U	5 U	5 U
Methylcyclohexane	none	none	5,200	none	5 U	**3.9 J**	**1.5 J**	5 U	5 U	5 U	5 U
Methylene chloride	**5**	**4.6**	**4.3**	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl-tert-butyl ether (MTBE)	none	200	**11**	none	5 U	5 U	**33 J (3)**	5 U	**1.8 J**	5 U	5 U
Tetrachloroethene (PCE)	5	**0.7**	**0.1**	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	1,000	1,000	720	none	5 U	5 U	**4.7 J**	5 U	5 U	5 U	5 U
trans-1,2-Dichloroethene	100	100	120	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene (TCE)	**5**	**2.8**	**1.4**	none	**2.3 J (3)**	5 U	**37 J (1,2,3)**	**1.7 J (3)**	**8.5 J (1,2,3)**	5 U	5 U
Trichlorofluoromethane (Freon-11)	none	2,100	1,300	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl chloride (VC)	**2**	**0.015**	**0.02**	none	2 U	5 U	2 U	2 U	2 U	2 U	2 U
Xylene, total	10,000	**530**	**210**	none	5 U	5 U	**23**	5 U	5 U	5 U	5 U
Total Metals (µg/L)											
Arsenic	**10**	**50**	**0.045**	6.2	NA	NA	NA	NA	NA	NA	NA
Barium	2,000	2,000	2,600	80.6	NA	NA	NA	NA	NA	NA	NA
Cadmium	5	**1.75**	18	none	NA	NA	NA	NA	NA	NA	NA
Chromium	100	50	none	8.38	NA	NA	NA	NA	NA	NA	NA
Iron	none	**300**	**11,000**	4,740	**17,800 (2,3)**	NA	NA	NA	**35,500 (2,3)**	**4,960 (2)**	NA
Lead	15	15	none	1.7	NA	NA	NA	NA	NA	NA	NA
Manganese	none	**50**	**880**	93.4	**195 (2)**	NA	NA	NA	**80.2 (2)**	**33.7**	NA
Mercury	2	1.05	none		NA	NA	NA	NA	NA	NA	NA
Selenium	50	50	180	1.38	NA	NA	NA	NA	NA	NA	NA
Dissolved Gases (mg/L)											
Methane	none	none	none	none	1.00E-03 U	NA	NA	NA	1.00E-03 U	1.00E-03 U	NA
Ethane	none	none	none	none	0.002 U	NA	NA	NA	0.002 U	0.002 U	NA
Ethene	none	none	none	none	0.002 U	NA	NA	NA	0.002 U	0.002 U	NA
Wet Chemistry (mg/L)											
Chloride	none	250	none	none	**6.96**	NA	NA	NA	**4.33**	**4.58**	NA
Nitrate	10	10	10	none	**0.04 J**	NA	NA	NA	**0.115**	0.05 U	NA
Nitrite	1	1	1	none	**0.03 J**	NA	NA	NA	0.05 U	**0.045 J**	NA
Sulfate	none	**250**	none	none	**115**	NA	NA	NA	**58.7**	**33.8**	NA
Sulfide	none	none	none	none	1 U	NA	NA	NA	1 U	1 U	NA
Total organic carbon (TOC)	none	none	none	none	**6.68**	NA	NA	NA	**6.32**	**5.55**	NA

Notes and Abbreviations:

- Bold value indicates detection
- The highest detected value (or lowest detection limit for nondetect) was selected for parent/duplicate sample pairs.
- Each screening criteria has been assigned a reference number listed in parentheses in the column header. The reference number is used to identify specific criteria exceeded in a particular sample. Refer to Section 5.1.4 for discussion of screening criteria.
- **Detections that exceed one or more screening values are indicated by bold red font.**
- **Detections that exceed the NC2L Groundwater Standards are indicated by bold blue font (and potentially other screening values [i.e., blue font subsumes red font]).**
- Background value is two times the average background concentration as reported in Table 5-2.
- MCL - Maximum Contaminant Level (refer to Section 5.1.4)
- NC2L - 'Class GA' groundwater quality criteria as defined in the North Carolina Administrative Code, Title 15A, Chapter 2, Subchapter 2L (refer to Section 5.1.4)
- PRG - Preliminary Remediation Goal (refer to Section 5.1.4)

mg/L - milligrams per liter µg/L - micrograms per liter NA - Not Analyzed
U - Not detected above associated value R- Value rejected by data validator; unusable
J - Estimated value below practical quantitation limit, but above method detection limit

Table 5-5
Lower Surficial Aquifer Groundwater Detections
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station Identification	MCL	NC2L Groundwater Standard (2)	USEPA Region 9 PRG Tap Water (3)	2 x Background (Inorganics)	OU1-MW62	OU14-13GW11		OU14-13GW143		OU14-13GW144		OU14-13GW29		OU14-56GW07	OU14-56GW09		OU14-56GW12	OU14-66GW13	OU14-66GW14
Sample Identification					OU1-MW62-03D	OU14-13GW11-03D	OU14-13GW11-05B	OU14-13GW143-03D	OU14-13GW143-05B	OU14-13GW144-03D	OU14-13GW144-05B	OU14-13GW29-03D	OU14-13GW29-05B	OU14-56GW07-03D	OU14-56GW09-03D	OU14-56GW09-05B	OU14-56GW12-03D	OU14-66GW13-03D	OU14-66GW14-03D
Sample Date	(1)				10/22/03	10/28/03	20/05	10/28/03	04/15/05	10/29/03	04/15/05	10/24/03	04/21/05	10/29/03	10/24/03	04/21/05	10/27/03	10/30/03	10/30/03
Volatile Organic Compounds (µg/L)																			
1,1-Dichloroethane (1,1-DCA)	none	70	810	none	**5 J**	**29**	**35**	**17**	**15**	**1 J**	5 U	100 U	**0.8 J**	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethene	7	7	340	none	5 U	10 U	**2.4 J**	5 U	**1.2 J**	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	70	70	7.2	none	5 U	10 U	5 U	5 U	**4 J**	5 U	**4.7 J**	100 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane (1,2-DCA)	**5**	**0.38**	**0.12**	none	**0.5 J (2,3)**	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	**0.4 J (2,3)**	5 U	5 U	5 U	5 U
1,2-Dichloroethene (total)	**70**	none	none	none	10 U	**190 (1)**	NA	**55**	NA	**10**	NA	**65 J**	NA	10 U	**11**	NA	10 U	10 U	10 U
2-Butanone	none	4,200	7,000	none	5 U	10 R	13 U	5 R	13 U	5 R	13 U	500 U	**2.4 J**	5 R	25 U	13 U	25 U	5 R	5 R
2-Hexanone	none	280	none	none	5 U	10 U	13 U	5 U	13 U	5 U	13 U	500 U	13 U	5 U	25 U	13 U	25 U	5 U	5 U
Acetone	none	700	5,500	none	5 R	10 R	13 U	5 R	13 U	5 R	13 U	500 R	13 U	**17 J**	25 U	14 U	25 U	5 R	5 R
Benzene	**5**	**1**	**0.34**	none	**1 J (2,3)**	**4 J (2,3)**	**7.6 (1,2,3)**	**38 (1,2,3)**	**34 (1,2,3)**	**16 (1,2,3)**	**9.8 (1,2,3)**	**2,000 (1,2,3)**	**870 (1,2,3)**	**13 (1,2,3)**	**16 (1,2,3)**	**2.6 J (2,3)**	**0.2 J**	5 U	**28 (1,2,3)**
Bromomethane	none	none	8.7	none	5 U	10 U	5 UJ	5 U	5 R	5 U	5 R	100 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U
Carbon disulfide	none	700	1,000	none	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	**70**	**70**	**61**	none	**0.9 J**	**190 (1,2,3)**	**180 (1,2,3)**	**55**	**51**	**10**	**12**	**65 J (3)**	**98 (1,2,3)**	5 U	**11**	5 U	5 U	5 U	5 U
Cumene (isopropylbenzene)	none	**70**	660	none	**2 J**	10 U	5 U	5 U	5 U	**0.2 J**	5 U	**18 J**	**23**	**25**	**0.4 J**	**1.1 J**	5 U	5 U	5 U
Cyclohexane	none	none	10,300	none	**6**	10 U	5 U	**24**	**32**	**2 J**	**2.3 J**	**43 J**	**110**	**2 J**	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane (Freon-12)	none	1,400	390	none	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	700	550	1,340	none	5 U	10 U	5 U	**0.7 J**	**1.2 J**	**1 J**	5 U	**130**	**130**	**98**	5 U	5 U	**0.1 J**	5 U	5 U
Methylcyclohexane	none	none	5,200	none	5 U	10 U	5 U	**2 J**	**2.4 J**	5 U	5 U	100 U	**32**	**3 J**	5 U	5 U	5 U	5 U	5 U
Methyl-tert-butyl ether (MTBE)	none	200	**11**	none	5 U	10 U	5 U	**2 J**	**2.9 J**	5 U	5 U	**170 (3)**	**76 (3)**	5 U	5 U	5 U	5 U	5 U	5 U
Styrene	100	100	1,600	none	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	**0.5 J**	5 U	5 U	5 U	5 U	5 U
Toluene	1,000	1,000	720	none	5 U	10 U	5 U	5 U	5 U	**0.3 J**	5 U	**54 J**	**28**	**24**	5 U	5 U	5 U	5 U	5 U
trans-1,2-Dichloroethene	100	100	120	none	5 U	10 U	**2.1 J**	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene (TCE)	**5**	**2.8**	**1.4**	none	5 U	**3 J (2,3)**	**8.1 J (1,2,3)**	**8 (1,2,3)**	**11 J (1,2,3)**	**6 (1,2,3)**	**10 J (1,2,3)**	100 U	5 U	5 U	**98 (1,2,3)**	**15 J (1,2,3)**	5 U	5 U	5 U
Trichlorofluoromethane (Freon-11)	none	2,100	1,300	none	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl chloride	**2**	**0.015**	**0.02**	none	5 U	10 U	2 U	5 U	2 U	5 U	2 U	100 U	**2.3 (1,2,3)**	5 U	5 U	2 U	5 U	5 U	5 U
Xylene, total	10,000	**530**	**210**	none	15 U	30 U	5 U	**0.2 J**	5 U	**1 J**	5 U	**730 (2,3)**	**410 (3)**	**200**	15 U	5 U	15 U	15 U	15 U
Total Metals (µg/L)																			
Arsenic	10	50	**0.045**	6.2	4.26 U	2.13 U	NA	2.13 U	NA	2.13 U	NA	2.13 U	NA	2.13 U	**6.6 J (3)**	NA	2.13 U	2.13 U	2.13 U
Barium	2,000	2,000	2,600	81	**124**	**78**	NA	**80.4**	NA	**37.7**	NA	**38.3**	NA	**17.8**	**67.9**	NA	**59.5**	**84.0**	**18.3**
Cadmium	5	**1.75**	18	none	**4 J (2)**	**4.6 J (2)**	NA	0.25 U	NA	0.25 U	NA	0.25 U	NA	0.25 U	0.25 U	NA	0.25 U	**0.27 J**	0.25 U
Chromium	100	50	none	8.4	**1.9 J**	**1.3 J**	NA	**1.2 J**	NA	0.88 U	NA	0.88 U	NA	**3.4 J**	**1.7 J**	NA	0.88 U	**1.1 J**	**1.7 J**
Iron	none	**300**	11,000	4,740	NA	NA	**4,200 (2)**	NA	NA	NA	NA	NA	NA	NA	NA	**10,300 (2)**	NA	NA	NA
Lead	15	15	none	1.7	3.12 U	**12.9**	NA	1.56 U	NA	1.56 U	NA	1.56 U	NA	1.56 U	1.56 U	NA	1.56 U	1.56 U	1.56 U
Manganese	none	**50**	880	93	NA	NA	**56 (2)**	NA	NA	NA	NA	NA	NA	NA	NA	**49.8**	NA	NA	NA
Mercury	2	1.05	none	none	0.04 U	**0.06 J**	NA	**0.04 J**	NA	0.04 UJ	NA	0.04 UJ	NA	0.04 UJ	**0.05 J**	NA	0.04 UJ	0.04 U	0.04 U
Selenium	50	50	180	1.4	4.64 U	2.32 UJ	NA	**2.5 J**	NA	2.32 UJ	NA	2.32 U	NA	2.32 UJ	**3.9 J**	NA	3 J	2.32 U	**4 J**
Silver	none	17.5	180	none	**1.6 J**	1.16 U	NA	1.16 U	NA	1.16 U	NA	1.16 U	NA	1.16 U	1.16 U	NA	1.16 U	1.16 U	1.16 U
Dissolved Gases (mg/L)																			
Methane	none	none	none	none	NA	NA	**0.19**	NA	NA	NA	NA	NA	NA	NA	NA	**0.077**	NA	NA	NA
Ethane	none	none	none	none	NA	NA	0.002 U	NA	NA	NA	NA	NA	NA	NA	NA	0.002 U	NA	NA	NA
Ethene	none	none	none	none	NA	NA	**4.00E-05 J**	NA	NA	NA	NA	NA	NA	NA	NA	0.002 U	NA	NA	NA
Wet Chemistry (mg/L)																			
Chloride	none	250	none	none	NA	NA	**9.5**	NA	NA	NA	NA	NA	NA	NA	NA	**13.2**	NA	NA	NA
Nitrate	10	10	10	none	0.05 U	0.05 U	**0.08**	**0.085**	NA	0.05 U	NA	0.05 U	NA	0.05 U	0.05 U	**0.02 J**	0.05 U	**0.59**	**0.1**
Nitrite	1	1	1	none	NA	NA	**0.19**	NA	NA	NA	NA	NA	NA	NA	NA	0.05 U	NA	NA	NA
Sulfate	none	**250**	none	none	**2,000 (2)**	**20**	**24.2**	**15**	NA	**1.6**	NA	1 U	NA	2 U	**34**	**23**	**25**	**19**	**35**
Sulfide	none	none	none	none	NA	NA	1 U	NA	NA	NA	NA	NA	NA	NA	NA	1 U	NA	NA	NA
Total organic carbon (TOC)	none	none	none	none	NA	NA	**4.98 J**	NA	NA	NA	NA	NA	NA	NA	NA	**9.01**	NA	NA	NA

Notes and Abbreviations:

- Bold value indicates detection
- The highest detected value (or lowest detection limit for nondetect) was selected for parent/duplicate sample pairs.
- Each screening criteria has been assigned a reference number listed in parentheses in the column header. The reference number is used to identify specific criteria exceeded in a particular sample. Refer to Section 5.1.4 for discussion of screening criteria.
- **Detections that exceed one or more screening values are indicated by bold red font.**
- **Detections that exceed the NC2L Groundwater Standards are indicated by bold blue font (and potentially other screening values [i.e., blue font subsumes red font]).**
- Background value is two times the average background concentration as reported in Table 5-2.
- MCL - Maximum Contaminant Level (refer to Section 5.1.4)
- NC2L - 'Class GA' groundwater quality criteria as defined in the North Carolina Administrative Code, Title 15A, Chapter 2, Subchapter 2L (refer to Section 5.1.4)
- PRG - Preliminary Remediation Goal (refer to Section 5.1.4)

mg/L - milligrams per liter µg/L - micrograms per liter NA - Not Analyzed
U - Not detected above associated value R- Value rejected by data validator; unusable
J - Estimated value below practical quantitation limit, but above method detection limit

Table 5-5
Lower Surficial Aquifer Groundwater Detections
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station Identification	MCL	NC2L Groundwater Standard (2)	USEPA Region 9 PRG Tap Water (3)	2 x Background (Inorganics)	OU14-66GW29		OU14-66GW33	OU14-66GW46		OU14-72GW07	OU14-72GW12	OU14-72GW19		OU14-72GW20	OU14-72GW24	OU14-72GW25	OU14-72GW27		OU14-72GW29
Sample Identification					OU14-66GW29-03D	OU14-66GW29-05B	OU14-66GW33-03D	OU14-66GW46-03D	OU14-66GW46-05B	OU14-72GW07-03D	OU14-72GW12-03D	OU14-72GW19-03D	OU14-72GW19-05B	OU14-72GW20-03D	OU14-72GW24-03D	OU14-72GW25-03D	OU14-72GW27-03D	OU14-72GW27-05B	OU14-72GW29-03D
Sample Date	(1)				10/23/03	04/21/05	10/29/03	10/30/03	04/19/05	10/23/03	10/22/03	10/31/03	04/20/05	10/24/03	10/23/03	10/23/03	10/23/03	04/21/05	10/22/03
Volatile Organic Compounds (µg/L)																			
1,1-Dichloroethane (1,1-DCA)	none	70	810	none	**4 J**	5 U	**0.4 J**	5 U	5 U	**0.4 J**	**2 J**	**0.9 J**	5 U	**2 J**	**0.2 J**	**2 J**	**130 (2)**	**66**	**0.5 J**
1,1-Dichloroethene	7	7	340	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**0.6 J**	5 U	**0.4 J**	5 U	5 U	5 U	**1.3 J**	5 U
1,2,4-Trichlorobenzene	70	70	7.2	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane (1,2-DCA)	**5**	**0.38**	**0.12**	none	5 U	5 U	**0.5 J (2,3)**	**0.3 J (3)**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethene (total)	**70**	none	none	none	**6 J**	NA	**9 J**	**3 J**	NA	10 U	10 U	**140 (1)**	NA	10 U	**23**	**2 J**	**19**	NA	10 U
2-Butanone	none	4,200	7,000	none	5 R	13 U	5 R	5 R	13 U	5 R	5 U	5 R	13 U	25 U	5 R	5 R	5 R	13 U	5 U
2-Hexanone	none	280	none	none	5 U	13 U	5 U	5 U	13 U	**3 J**	5 U	5 U	13 U	25 U	5 U	5 U	5 U	13 U	5 U
Acetone	none	700	5,500	none	5 R	**2.9 J**	5 R	5 R	28 U	5 R	5 R	5 R	13 U	25 U	5 R	5 R	5 R	13 U	5 R
Benzene	**5**	**1**	**0.34**	none	**4 J (2,3)**	5 U	**2 J (2,3)**	**0.8 J (3)**	5 U	**66 (1,2,3)**	5 U	**0.8 J (3)**	**1.4 J (2,3)**	5 U	**0.5 J (3)**	5 U	**4 (2,3)**	**2.1 J (2,3)**	**6 (1,2,3)**
Bromomethane	none	none	8.7	none	5 U	5 U	5 U	5 U	**1.6 J**	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 U
Carbon disulfide	none	700	1,000	none	5 U	5 U	5 U	5 U	**1.3 J**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	**70**	**70**	**61**	none	**6**	5 U	**9**	**3 J**	5 U	5 U	**1 J**	**110 (1,2,3)**	**92 (1,2,3)**	5 U	**23**	**2 J**	**19**	**12**	**1 J**
Cumene (isopropylbenzene)	none	**70**	660	none	**0.3 J**	5 U	5 U	5 U	5 U	**3 J**	5 U	5 U	5 U	5 U	5 U	5 U	**0.5 J**	**0.23 J**	**85 (2)**
Cyclohexane	none	none	10,300	none	**37**	5 U	**3 J**	5 U	5 U	**64**	**5**	5 U	5 U	5 U	5 U	**5**	**11**	**5.2**	**8**
Dichlorodifluoromethane (Freon-12)	none	1,400	390	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**6**	5 U	5 U
Ethylbenzene	700	550	1,340	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**0.1 J**	5 U	5 U	5 U	5 U	**1 J**
Methylcyclohexane	none	none	5,200	none	5 U	5 U	5 U	5 U	5 U	**12**	5 U	5 U	5 U	5 U	5 U	5 U	**7**	**5.4**	**2 J**
Methyl-tert-butyl ether (MTBE)	none	200	**11**	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**0.38 J**	5 U
Styrene	100	100	1,600	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	1,000	1,000	720	none	**0.5 J**	5 U	5 U	5 U	5 U	**2 J**	5 U	5 U	5 U	5 U	5 U	5 U	**0.2 J**	5 U	**0.2 J**
trans-1,2-Dichloroethene	100	100	120	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**23**	**25**	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene (TCE)	**5**	**2.8**	**1.4**	none	**5 (1,2,3)**	**1.2 J**	5 U	**1 J**	**1.4 J**	5 U	5 U	**22 (1,2,3)**	**19 J (1,2,3)**	5 U	5 U	5 U	**5 J (1,2,3)**	**4 J (2,3)**	**1 J**
Trichlorofluoromethane (Freon-11)	none	2,100	1,300	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl chloride	**2**	**0.015**	**0.02**	none	5 U	2 U	5 U	5 U	2 U	5 U	5 U	5 U	2 U	5 U	5 U	5 U	**2 J (1,2,3)**	2 U	5 U
Xylene, total	10,000	**530**	**210**	none	15 U	5 U	15 U	15 U	5 U	**4 J**	15 U	15 U	5 U	15 U	15 U	15 U	**0.4 J**	5 U	15 U
Total Metals (µg/L)																			
Arsenic	10	50	**0.045**	6.2	2.13 U	NA	2.13 U	2.13 U	NA	2.13 U	2.13 U	2.13 U	NA	2.13 U	**2.8 J (2,3)**	2.13 U	2.13 U	NA	2.13 U
Barium	2,000	2,000	2,600	81	**58.4**	NA	**140**	**72.4**	NA	**53.0**	**133**	**111**	NA	**57.9**	**47.9**	**38.8**	**65.6**	NA	**62.5**
Cadmium	5	**1.75**	18	none	0.25 U	NA	0.25 U	0.25 U	NA	0.25 U	**2 J (2)**	0.25 U	NA	0.25 U	0.25 U	0.25 U	0.25 U	NA	**0.53 J**
Chromium	100	50	none	8.4	**0.92 J**	NA	**5.1 J**	**1.8 J**	NA	0.88 U	**2.8 J**	**2 J**	NA	0.88 U	0.88 U	0.88 U	**1.3 J**	NA	**2.1 J**
Iron	none	**300**	11,000	4,740	NA	NA	NA	NA	NA	NA	NA	NA	**1,720 (2)**	NA	NA	NA	NA	**1,930 (2)**	NA
Lead	15	15	none	1.7	1.56 U	NA	1.56 U	1.56 U	NA	1.56 U	**6.2**	**4 J**	NA	1.56 U	1.7 U	2.5 U	2.2 U	NA	**8.6**
Manganese	none	**50**	880	93	NA	NA	NA	NA	NA	NA	NA	NA	**169 (2)**	NA	NA	NA	NA	**35.7**	NA
Mercury	2	1.05	none	none	**0.06 J**	NA	**0.05 J**	0.04 U	NA	0.04 U	0.04 U	**0.07 J**	NA	0.04 UJ	0.04 U	0.04 U	0.04 U	NA	0.04 U
Selenium	50	50	180	1.4	2.32 U	NA	**3.2 J**	2.32 U	NA	2.32 U	**3.7 J**	2.32 U	NA	2.32 U	2.32 U	2.32 U	2.32 U	NA	**2.7 J**
Silver	none	17.5	180	none	1.16 U	NA	1.16 U	1.16 U	NA	1.16 U	1.16 U	1.16 U	NA	1.16 U	1.16 U	1.16 U	1.16 U	NA	1.16 U
Dissolved Gases (mg/L)																			
Methane	none	none	none	none	NA	NA	NA	NA	NA	NA	NA	NA	**0.051**	NA	NA	NA	NA	**0.21**	NA
Ethane	none	none	none	none	NA	NA	NA	NA	NA	NA	NA	NA	0.002 U	NA	NA	NA	NA	**3.00E-04 J**	NA
Ethene	none	none	none	none	NA	NA	NA	NA	NA	NA	NA	NA	**7.00E-05 J**	NA	NA	NA	NA	0.002 U	NA
Wet Chemistry (mg/L)																			
Chloride	none	250	none	none	NA	NA	NA	NA	NA	NA	NA	NA	**7**	NA	NA	NA	NA	**8.64**	NA
Nitrate	10	10	10	none	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	0.05 U	0.05 U	**0.04 J**	0.05 U	**0.42 J**	0.05 U	0.05 U	**0.015 J**	0.05 U
Nitrite	1	1	1	none	NA	NA	NA	NA	NA	NA	NA	NA	0.05 U	NA	NA	NA	NA	0.05 U	NA
Sulfate	none	**250**	none	none	**32**	NA	**96**	**79**	NA	1 U	**1,000 (2)**	**12**	**122**	**14**	**14**	**14**	**51**	**75.2**	**27**
Sulfide	none	none	none	none	NA	NA	NA	NA	NA	NA	NA	NA	1 U	NA	NA	NA	NA	1 U	NA
Total organic carbon (TOC)	none	none	none	none	NA	NA	NA	NA	NA	NA	NA	NA	**4.65 J**	NA	NA	NA	NA	**8.88**	NA

Notes and Abbreviations:

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- Each screening criteria has been assigned a reference number listed in parentheses in the column header. The reference number is used to identify specific criteria exceeded in a particular sample. Refer to Section 5.1.4 for discussion of screening criteria.
- **Detections that exceed one or more screening values are indicated by bold red font.**
- **Detections that exceed the NC2L Groundwater Standards are indicated by bold blue font (and potentially other screening values [i.e., blue font subsumes red font]).**
- Background value is two times the average background concentration as reported in Table 5-2.
- MCL - Maximum Contaminant Level (refer to Section 5.1.4)
- NC2L - 'Class GA' groundwater quality criteria as defined in the North Carolina Administrative Code, Title 15A, Chapter 2, Subchapter 2L (refer to Section 5.1.4)
- PRG - Preliminary Remediation Goal (refer to Section 5.1.4)

mg/L - milligrams per liter µg/L - micrograms per liter NA - Not Analyzed
U - Not detected above associated value R- Value rejected by data validator; unusable
J - Estimated value below practical quantitation limit, but above method detection limit

Table 5-5
Lower Surficial Aquifer Groundwater Detections
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station Identification	MCL	NC2L Groundwater Standard (2)	USEPA Region 9 PRG Tap Water (3)	2 x Background (Inorganics)	OU14-72GW41	OU14-72GW43	OU14-90GW09	OU14-90GW10	OU14-90GW11	OU14-90GW12	OU14-90GW13	OU14-90GW14	OU14-90GW15	OU14-90GW16
Sample Identification					OU14-72GW41-03D	OU14-72GW43-03D	OU14-90GW09-05B	OU14-90GW10-05B	OU14-90GW11-05B	OU14-90GW12-05B	OU14-90GW13-05B	OU14-90GW14-05B	OU14-90GW15-05B	OU14-90GW16-05B
Sample Date	(1)				10/27/03	10/27/03	04/20/05	04/20/05	04/21/05	04/20/05	04/20/05	04/15/05	04/18/05	04/18/05
Volatile Organic Compounds (µg/L)														
1,1-Dichloroethane (1,1-DCA)	none	70	810	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethene	7	7	340	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	70	70	7.2	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane (1,2-DCA)	**5**	**0.38**	**0.12**	none	5 U	5 U	5 U	**21 (1,2,3)**	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethene (total)	**70**	none	none	none	10 U	10 U	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	none	4,200	7,000	none	25 U	25 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U
2-Hexanone	none	280	none	none	25 U	25 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U
Acetone	none	700	5,500	none	25 U	25 U	13 U	13 U	13 U	18 U	13 U	13 U	13 U	13 U
Benzene	**5**	**1**	**0.34**	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromomethane	none	none	8.7	none	5 U	5 U	5 UJ	5 U	5 U	5 UJ	5 UJ	5 R	5 R	5 UJ
Carbon disulfide	none	700	1,000	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	**70**	**70**	**61**	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**3 J**	5 U	**2.3 J**
Cumene (isopropylbenzene)	none	**70**	660	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Cyclohexane	none	none	10,300	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane (Freon-12)	none	1,400	390	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	700	550	1,340	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methylcyclohexane	none	none	5,200	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl-tert-butyl ether (MTBE)	none	200	**11**	none	5 U	**0.4 J**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Styrene	100	100	1,600	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	1,000	1,000	720	none	5 U	5 U	5 U	**0.14 J**	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,2-Dichloroethene	100	100	120	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene (TCE)	**5**	**2.8**	**1.4**	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**1.8 J (3)**	5 U
Trichlorofluoromethane (Freon-11)	none	2,100	1,300	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl chloride	**2**	**0.015**	**0.02**	none	5 U	5 U	2 U	5 U	2 U	2 U	2 U	2 U	2 U	2 U
Xylene, total	10,000	**530**	**210**	none	15 U	15 U	5 U	**0.19 J**	5 U	5 U	5 U	5 U	5 U	5 U
Total Metals (µg/L)														
Arsenic	10	50	**0.045**	6.2	2.13 U	**2.5 J (3)**	NA	NA	NA	NA	NA	NA	NA	NA
Barium	2,000	2,000	2,600	81	**40.1**	**53.8**	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	5	**1.75**	18	none	0.25 U	0.25 U	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	100	50	none	8.4	0.88 U	0.88 U	NA	NA	NA	NA	NA	NA	NA	NA
Iron	none	**300**	11,000	4,740	NA	NA	**7,910 (2)**	NA	NA	**7,200 (2)**	**734 (2)**	NA	NA	**5,430 (2)**
Lead	15	15	none	1.7	1.56 U	**1.6 J**	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	none	**50**	880	93	NA	NA	**134 (2)**	NA	NA	**513 (2)**	**11.2**	NA	NA	**143 (2)**
Mercury	2	1.05	none	none	0.04 UJ	0.04 UJ	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	50	50	180	1.4	2.32 U	2.32 U	NA	NA	NA	NA	NA	NA	NA	NA
Silver	none	17.5	180	none	1.16 U	1.16 U	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Gases (mg/L)														
Methane	none	none	none	none	NA	NA	**0.051**	NA	NA	**0.028**	**0.09**	NA	NA	**0.043**
Ethane	none	none	none	none	NA	NA	0.002 U	NA	NA	0.002 U	0.002 U	NA	NA	0.002 U
Ethene	none	none	none	none	NA	NA	**4.00E-05 J**	NA	NA	**3.00E-04 J**	0.002 U	NA	NA	**7.00E-05 J**
Wet Chemistry (mg/L)														
Chloride	none	250	none	none	NA	NA	**10.1**	NA	NA	**14.3**	**10.5**	NA	NA	**8.96**
Nitrate	10	10	10	none	**0.097**	0.05 U	0.05 U	NA	NA	0.05 U	**0.445**	NA	NA	**0.055**
Nitrite	1	1	1	none	NA	NA	**0.03 J**	NA	NA	0.05 U	0.05 U	NA	NA	0.05 U
Sulfate	none	**250**	none	none	**8.4**	**28**	**11.2**	NA	NA	**243**	**5.28**	NA	NA	**93.5**
Sulfide	none	none	none	none	NA	NA	1 U	NA	NA	2 U	1 U	NA	NA	1 U
Total organic carbon (TOC)	none	none	none	none	NA	NA	**9.58**	NA	NA	**25.9**	**4.68 J**	NA	NA	**9.28**

Notes and Abbreviations:

- Bold value indicates detection
- The highest detected value (or lowest detection limit for nondetect) was selected for parent/duplicate sample pairs.
- Each screening criteria has been assigned a reference number listed in parentheses in the column header. The reference number is used to identify specific criteria exceeded in a particular sample. Refer to Section 5.1.4 for discussion of screening criteria.
- **Detections that exceed one or more screening values are indicated by bold red font.**
- **Detections that exceed the NC2L Groundwater Standards are indicated by bold blue font (and potentially other screening values [i.e., blue font subsumes red font]).**
- Background value is two times the average background concentration as reported in Table 5-2.
- MCL - Maximum Contaminant Level (refer to Section 5.1.4)
- NC2L - 'Class GA' groundwater quality criteria as defined in the North Carolina Administrative Code, Title 15A, Chapter 2, Subchapter 2L (refer to Section 5.1.4)
- PRG - Preliminary Remediation Goal (refer to Section 5.1.4)

mg/L - milligrams per liter µg/L - micrograms per liter NA - Not Analyzed
U - Not detected above associated value R- Value rejected by data validator; unusable
J - Estimated value below practical quantitation limit, but above method detection limit

Table 5-6
Yorktown Aquifer Groundwater Detections
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station Identification	**MCL**	**NC2L Groundwater Standard (2)**	**USEPA Region 9 PRG Tap Water (3)**	OU14-90GW17		OU14-90GW18
Sample Identification				OU14-90GW17-05B	OU14-90GW17-0807	OU14-90GW18-05B
Sample Date	**(1)**			04/20/05	08/29/07 (No Detections)	04/20/05
Volatile Organic Compounds (µg/L)						
Acetone	none	700	5,500	**3.7 J**	0.5 U	13 U
Benzene	5	1	0.34	**0.19 J**	0.5 U	5 U
Bromodichloromethane	100	**0.56**	**0.18**	**2.9 J (2,3)**	0.5 U	5 U
Carbon disulfide	none	700	1,000	**1.8 J**	0.5 U	**3.1 J**
Cumene (isopropylbenzene)	none	70	660	**0.3 J**	0.5 U	5 U
Ethylbenzene	700	550	2.9	**1 J**	0.5 U	**0.13 J**
Tetrachloroethene (PCE)	5	0.7	**0.1**	**0.31 J (3)**	0.5 U	5 U
Toluene	1,000	1,000	720	**0.32 J**	0.5 U	**0.19 J**
Xylene, total	10,000	530	210	**2.9 J**	0.5 U	**0.53 J**

Notes and Abbreviations:

- Bold value indicates detection
- The highest detected value (or lowest detection limit for nondetect) was selected for parent/duplicate sample pairs.
- Each screening criteria has been assigned a reference number listed in parentheses in the column header. The reference number is used to identify specific criteria exceeded in a particular sample.
- **Detections that exceed one or more screening values are indicated by bold red font.**
- **Detections that exceed the NC2L Groundwater Standards are indicated by bold blue font (and potentially other screening values [i.e., blue font subsumes red font]).**
- **Monitoring well OU14-90GW17 was re-sampled in August 2007 to confirm the presence of bromodichloromethane and PCE. There were no detections of any chemical in the low concentration TCL VOC list (method CLP OLC03.2). This most recent data is considered representative of Yorktown Aquifer conditions at 90GW17.**
- MCL - Maximum Contaminant Level (refer to Section 5.1.4). MCL for Bromodichloromethane is the MCL for total trihalomethanes.
- NC2L - 'Class GA' groundwater quality criteria as defined in the North Carolina Administrative Code, Title 15A, Chapter 2, Subchapter 2L (refer to Section 5.1.4)
- PRG - Preliminary Remediation Goal (refer to Section 5.1.4)
- MCL for the cumulative total of trihalomethanes (chloroform, bromodichloromethane, dibromochloromethane, and bromoform), which are a byproduct of drinking water disinfection with chlorine, is 80 µg/L.

"--" - no criteria
µg/L - micrograms per liter
NA- Not analyzed
U - Not detected above associated value
J - Estimated value below practical quantitation limit, but above method detection limit

Table 5-7
Grab Groundwater Detections
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station Identification	MCL-Groundwater (1)	NC2L Groundwater Standard (2)	USEPA Region 9 PRG Tap Water (3)	9001GW		9002GW		9003GW		9004GW		9005GW	9006GW		9007GW	
Sample Identification				9001GW1216	9001GW3640	9002GW1216	9002GW3640	9003GW1216	9003GW3640	9004GW1216	9004GW4044	9005GW1216	9006GW1216	9006GW4044	9007GW1216	9007GW4044
Sample Date				10/16/02	10/16/02	10/16/02	10/16/02	10/16/02	10/16/02	10/21/02	10/21/02	10/21/02	10/17/02	10/17/02	10/18/02	10/18/02
Chemical Name																
VOCs (µg/L)																
1,1-Dichloroethane (1,1-DCA)	none	**70**	810	**51**	**10**	**3.9**	**8**	**720 (2)**	**5.2**	**10**	1 U	**7.6**	1 U	**9**	1 U	**15**
1,1-Dichloroethene	**7**	**7**	340	**0.67 J**	5 U	1 U	**2.2**	**38 (1,2)**	5 U	1 U	1 U	1 U	1 U	**0.7 J**	1 U	1 U
1,2,4-Trichlorobenzene	70	70	190	1 U	5 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane (1,2-DCA)	**5**	**0.38**	**0.12**	1 U	5 U	1 U	1 U	**4 (2,3)**	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	none	4,200	7,000	5 U	25 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone	none	280	none	5 U	25 U	5 U	5 U	**4.6 J**	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone (MIBK)	none	none	2,000	5 U	25 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	none	700	5,500	5 U	25 U	5 U	**12**	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	**5**	**1**	**0.34**	**3.1 (2,3)**	**150 (1,2,3)**	**1.4 (2,3)**	1 U	**9.4 (1,2,3)**	**9.2 (1,2,3)**	**0.76 J (3)**	1 U	**600 (1,2,3)**	1 U	**11 (1,2,3)**	1 U	**250 (1,2,3)**
Carbon disulfide	none	700	1,000	1 U	5 U	3.1 U	1 U	**1.3**	5 U	**1.1**	**0.96 J**	1 U	1 U	1 U	1.5 U	1 U
Chloroethane	none	2,800	**4.6**	**6.9 (3)**	5 U	1 U	1 U	**47 (3)**	5 U	1 U	1 U	**9.1 (3)**	1 U	1 U	1 U	1 U
Chloroform	80	70	**0.2**	1 U	5 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane	none	**2.6**	160	1 U	5 U	**2.6 (2)**	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	**70**	**70**	**61**	**5.9**	5 U	**6.4**	1 U	**150 (1,2,3)**	5 U	**1.8**	**7.2**	1 U	**0.54 J**	**3.9**	1 U	**1.3**
Cumene (isopropylbenzene)	none	70	660	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyclohexane	none	none	10,300	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	700	550	1,340	1 U	**140**	1 U	1 U	**2.3**	**130**	1 U	1 U	**66**	1 U	1 U	1 U	**1.9**
Methylcyclohexane	none	none	5,200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	**5**	**4.6**	**4.3**	1.5 U	14 U	1.3 U	1.5 U	2 U	14 U	1.2 U	1.3 U	2 U	1 U	2.5 U	1 U	1 U
Methyl-tert-butyl ether (MTBE)	none	200	**11**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	100	100	1,600	1 U	5 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	1,000	1,000	720	1 U	5 U	1 U	1 U	**5.3**	5 U	1 U	1 U	**7.7**	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	100	100	120	1 U	5 U	1 U	1 U	**3.2**	5 U	1 U	**0.7 J**	1 U	1 U	1 U	1 U	1 U
Trichloroethene (TCE)	**5**	**2.8**	1.4	1 U	5 U	**0.55 J**	**0.67 J**	1 U	5 U	1 U	**24 (1,2,3)**	1 U	**0.64 J**	**1.2**	1 U	1 U
Vinyl chloride (VC)	**2**	**0.015**	**0.02**	**28 (1,2,3)**	5 U	1 U	1 U	**850 (1,2,3)**	5 U	**1.9 (2,3)**	1 U	**1.6 (2,3)**	1 U	1 U	1 U	1 U
Xylene, total	10,000	**530**	**206**	1 U	5 U	1 U	1 U	**17**	5 U	1 U	1 U	**980 (2,3)**	1 U	1 U	1 U	**2.4**

Notes and Abbreviations:

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- Each screening criteria has been assigned a reference number listed in parentheses in the column header. The reference number is used to identify specific criteria exceeded in a particular sample. Refer to Section 5.1.4 for discussion of screening criteria.
- **Detections that exceed one or more screening values are indicated by bold red font.**
- **Detections that exceed the NC2L Groundwater Standards are indicated by bold blue font (and potentially other screening values [i.e., blue font subsumes red font]).**
- Background value is two times the average background concentration as reported in Table 5-2.
- MCL - Maximum Contaminant Level (refer to Section 5.1.4)
- NC2L - 'Class GA' groundwater quality criteria as defined in the North Carolina Administrative Code, Title 15A, Chapter 2, Subchapter 2L (refer to Section 5.1.4)
- PRG - Preliminary Remediation Goal (refer to Section 5.1.4)

mg/L - milligrams per liter µg/L - micrograms per liter NA - Not Analyzed

U - Not detected above associated value

J - Estimated value below practical quantitation limit, but above method detection limit

Table 5-7
Grab Groundwater Detections
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station Identification	MCL-Groundwater (1)	NC2L Groundwater Standard (2)	USEPA Region 9 PRG Tap Water (3)	9008GW		9009GW		9010GW		9011GW	9012GW		9013GW		9014GW	
Sample Identification				9008GW0812	9008GW4448	9009GW0812	9009GW4448	9010GW1216	9010GW4448	9011GW4448	9012GW1216	9012GW4650	9013GW1216	9013GW4650	9014GW1216	9014GW4050
Sample Date				10/18/02	10/18/02	10/17/02	10/17/02	10/17/02	10/17/02	10/17/02	10/20/02	10/20/02	10/18/02	10/18/02	10/18/02	10/18/02
Chemical Name																
VOCs (µg/L)																
1,1-Dichloroethane (1,1-DCA)	none	**70**	810	1 U	**1.2**	25 U	25 U	1 U	**30**	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	**7**	**7**	340	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	70	70	190	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane (1,2-DCA)	**5**	**0.38**	**0.12**	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	none	4,200	7,000	5 U	5 U	130 U	130 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone	none	280	none	5 U	5 U	130 U	130 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone (MIBK)	none	none	2,000	5 U	5 U	130 U	130 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	none	700	5,500	**4.1 J**	5 U	130 U	130 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**3.1 J**
Benzene	**5**	**1**	**0.34**	**16 (1,2,3)**	**16 (1,2,3)**	**210 (1,2,3)**	**25 J (1,2,3)**	1 U	**2.5 (2,3)**	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon disulfide	none	700	1,000	2.6 U	1.3 U	**20 J**	**88**	1 U	1 U	2.3 U	1 U	**2**	1 U	1.3 U	1 U	1.6 U
Chloroethane	none	2,800	**4.6**	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	80	70	**0.2**	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane	none	**2.6**	160	1 U	1 U	25 U	**21 J (2)**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	**70**	**70**	**61**	1 U	**35**	25 U	**57**	1 U	**8.8**	**1.8**	1 U	1 U	1 U	1 U	1 U	1 U
Cumene (isopropylbenzene)	none	70	660	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyclohexane	none	none	10,300	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	700	550	1,340	**12**	**1**	**160**	**30**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylcyclohexane	none	none	5,200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	**5**	**4.6**	**4.3**	1 U	1 U	**36 (1,2,3)**	**37 (1,2,3)**	2.1 U	2.3 U	1 U	1.2 U	1.1 U	1 U	1 U	1 U	1 U
Methyl-tert-butyl ether (MTBE)	none	200	**11**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	100	100	1,600	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	1,000	1,000	720	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	100	100	120	1 U	**7.5**	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene (TCE)	**5**	**2.8**	1.4	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl chloride (VC)	**2**	**0.015**	**0.02**	**0.56 J (2,3)**	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylene, total	10,000	**530**	**206**	**12**	**2**	**250 (3)**	**77**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Notes and Abbreviations:

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- The highest detected value (or lowest detection limit for nondetect) was selected for parent/duplicate sample pairs.
- Each screening criteria has been assigned a reference number listed in parentheses in the column header. The reference number is used to identify specific criteria exceeded in a particular sample. Refer to Section 5.1.4 for discussion of screening criteria.
- **Detections that exceed one or more screening values are indicated by bold red font.**
- **Detections that exceed the NC2L Groundwater Standards are indicated by bold blue font (and potentially other screening values [i.e., blue font subsumes red font]).**
- Background value is two times the average background concentration as reported in Table 5-2.
- MCL - Maximum Contaminant Level (refer to Section 5.1.4)
- NC2L - 'Class GA' groundwater quality criteria as defined in the North Carolina Administrative Code, Title 15A, Chapter 2, Subchapter 2L (refer to Section 5.1.4)
- PRG - Preliminary Remediation Goal (refer to Section 5.1.4)

mg/L - milligrams per liter µg/L - micrograms per liter NA - Not Analyzed

U - Not detected above associated value

J - Estimated value below practical quantitation limit, but above method detection limit

Table 5-7
Grab Groundwater Detections
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station Identification	MCL-Groundwater (1)	NC2L Groundwater Standard (2)	USEPA Region 9 PRG Tap Water (3)	9015GW		9016GW		9017GW		9018GW		9019GW		9020GW		9021GW	
Sample Identification				9015GW1216	9015GW4650	9016GW1216	9016GW4448	9017GW1216	9017GW4448	9018GW1216	9018GW4650	9019GW1216	9019GW4650	9020GW1216	9020GW3640	9021GW1216	9021GW4044
Sample Date				10/18/02	10/18/02	10/20/02	10/20/02	10/20/02	10/20/02	10/20/02	10/20/02	10/20/02	10/21/02	10/21/02	10/21/02	10/21/02	10/21/02
Chemical Name																	
VOCs (µg/L)																	
1,1-Dichloroethane (1,1-DCA)	none	**70**	810	1 U	1 U	1 U	1 U	1 U	**3.1**	1 U	**18**	**6.4**	**52**	**28**	**11**	1 U	**0.99 J**
1,1-Dichloroethene	**7**	**7**	340	1 U	1 U	1 U	1 U	1 U	**1.3**	1 U	**2.2**	1 U	**2.2**	1 U	**5.5**	1 U	1 U
1,2,4-Trichlorobenzene	70	70	190	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane (1,2-DCA)	**5**	**0.38**	**0.12**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	none	4,200	7,000	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone	none	280	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone (MIBK)	none	none	2,000	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	none	700	5,500	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**10**
Benzene	**5**	**1**	**0.34**	**9 (1,2,3)**	1 U	**3.7 (2,3)**	1 U	**0.56 J (3)**	**4 (2,3)**	1 U	**2.3 (2,3)**	1 U	**2.5 (2,3)**	**1,000 (1,2,3)**	**1,500 (1,2,3)**	**140 (1,2,3)**	**58 (1,2,3)**
Carbon disulfide	none	700	1,000	2.9 U	2.8 U	**0.73 J**	**3.1**	**1.5**	**5.1**	1 U	**3.3**	1 U	**1.4**	**0.88 J**	**2.7**	1 U	1.9
Chloroethane	none	2,800	**4.6**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	80	70	**0.2**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane	none	**2.6**	160	**1.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	**70**	**70**	**61**	**42**	1 U	**9.3**	1 U	**43**	**130 (1,2,3)**	1 U	**300 (1,2,3)**	**2.7**	**54**	1 U	1 U	1 U	1 U
Cumene (isopropylbenzene)	none	70	660	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyclohexane	none	none	10,300	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	700	550	1,340	1 U	1 U	**4.6**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**160**	**97**	1 U	**0.73 J**
Methylcyclohexane	none	none	5,200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	**5**	**4.6**	**4.3**	1 U	1 U	1.6 U	1.6 U	2.5 U	1.3 U	1.5 U	1.2 U	1.2 U	1.2 U	1.9 U	1.2 U	1 U	1.2 U
Methyl-tert-butyl ether (MTBE)	none	200	**11**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	100	100	1,600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	1,000	1,000	720	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**39**	3 U	**8.5**	1.1 U
trans-1,2-Dichloroethene	100	100	120	**1.8**	1 U	1 U	1 U	**3.3**	**16**	1 U	**33**	1 U	**3.1**	1 U	1 U	1 U	1 U
Trichloroethene (TCE)	**5**	**2.8**	1.4	1 U	1 U	1 U	1 U	1 U	**69 (1,2,3)**	1 U	**16 (1,2,3)**	1 U	**12 (1,2,3)**	1 U	1 U	1 U	1 U
Vinyl chloride (VC)	**2**	**0.015**	**0.02**	1 U	1 U	**0.69 J (2,3)**	1 U	**1.6 (2,3)**	**2.7 (1,2,3)**	1 U	**2.4 (1,2,3)**	1 U	1 U	1 U	1 U	1 U	1 U
Xylene, total	10,000	**530**	**206**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**1,800 (2,3)**	**38**	**190**	**1.1**

Notes and Abbreviations:

- Bold value indicates detection
- The highest detected value (or lowest detection limit for nondetect) was selected for parent/duplicate sample pairs.
- Each screening criteria has been assigned a reference number listed in parentheses in the column header. The reference number is used to identify specific criteria exceeded in a particular sample. Refer to Section 5.1.4 for discussion of screening criteria.
- **Detections that exceed one or more screening values are indicated by bold red font.**
- **Detections that exceed the NC2L Groundwater Standards are indicated by bold blue font (and potentially other screening values [i.e., blue font subsumes red font]).**
- Background value is two times the average background concentration as reported in Table 5-2.
- MCL - Maximum Contaminant Level (refer to Section 5.1.4)
- NC2L - 'Class GA' groundwater quality criteria as defined in the North Carolina Administrative Code, Title 15A, Chapter 2, Subchapter 2L (refer to Section 5.1.4)
- PRG - Preliminary Remediation Goal (refer to Section 5.1.4)

mg/L - milligrams per liter µg/L - micrograms per liter NA - Not Analyzed

U - Not detected above associated value

J - Estimated value below practical quantitation limit, but above method detection limit

Table 5-7
Grab Groundwater Detections
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station Identification	MCL-Groundwater (1)	NC2L Groundwater Standard (2)	USEPA Region 9 PRG Tap Water (3)	9022GW		9023GW		9024GW		9025GW		9026GW		9027GW		OU14-90GW02
Sample Identification				9022GW1216	9022GW4650	9023GW1216	9023GW4448	9024GW1216	9024GW4650	9025GW1216	9025GW4044	9026GW1216	9026GW4448	9027GW1216	9027GW4448	OU14-90GW02-1520-05B
Sample Date				10/20/02	10/20/02	10/22/02	10/22/02	10/22/02	10/22/02	10/22/02	10/22/02	10/22/02	10/22/02	10/22/02	10/22/02	04/13/05
Chemical Name																
VOCs (µg/L)																
1,1-Dichloroethane (1,1-DCA)	none	**70**	810	1 U	1 U	1 U	**75 (2)**	1 U	1 U	1 U	1 U	1 U	**1.9**	1 U	1 U	**5.2**
1,1-Dichloroethene	**7**	**7**	340	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5 U
1,2,4-Trichlorobenzene	70	70	190	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**3.5 J**
1,2-Dichloroethane (1,2-DCA)	**5**	**0.38**	**0.12**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**28 (1,2,3)**	1 U	1 U	1 U	5 U
2-Butanone	none	4,200	7,000	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	13 U
2-Hexanone	none	280	none	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	13 U
4-Methyl-2-pentanone (MIBK)	none	none	2,000	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	13 U
Acetone	none	700	5,500	5 U	5 U	5 U	**6.8**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**3 J**
Benzene	**5**	**1**	**0.34**	1 U	**1.9 (2,3)**	**73 (1,2,3)**	**27 (1,2,3)**	**440 (1,2,3)**	**19 (1,2,3)**	**210 (1,2,3)**	**290 (1,2,3)**	**1,100 (1,2,3)**	**19 (1,2,3)**	**150 (1,2,3)**	**170 (1,2,3)**	5 U
Carbon disulfide	none	700	1,000	**16**	**6.7**	1 U	1.2 U	1 U	1 U	1 U	1 U	**1.1**	1 U	1 U	1 U	5 U
Chloroethane	none	2,800	**4.6**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5 U
Chloroform	80	70	**0.2**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5 U
Chloromethane	none	**2.6**	160	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5 U
cis-1,2-Dichloroethene	**70**	**70**	**61**	**0.77 J**	**32**	**0.66 J**	**170 (1,2,3)**	1 U	**90 (1,2,3)**	**1.5**	**7.1**	**1.2**	**6.8**	1 U	**12**	**18**
Cumene (isopropylbenzene)	none	70	660	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U
Cyclohexane	none	none	10,300	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U
Ethylbenzene	700	550	1,340	1 U	1 U	**43**	1 U	**25**	**8.8**	**11**	**4**	**120**	**69**	**170**	**32**	5 U
Methylcyclohexane	none	none	5,200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U
Methylene chloride	**5**	**4.6**	**4.3**	1.3 U	1.3 U	3.3 U	2.7 U	2.8 U	3 U	3.1 U	3.7 U	2.3 U	2.7 U	2 U	2.7 U	5 U
Methyl-tert-butyl ether (MTBE)	none	200	**11**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U
Styrene	100	100	1,600	1 U	1 U	**0.87 J**	1 U	1 U	1 U	1 U	1 U	**2.5**	**1.3**	1 U	1 U	5 U
Toluene	1,000	1,000	720	1 U	1 U	**8.3**	1 U	1 U	1 U	1.1 U	1 U	**18**	**12**	1 U	1 U	5 U
trans-1,2-Dichloroethene	100	100	120	1 U	**4.1**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5 U
Trichloroethene (TCE)	**5**	**2.8**	1.4	1 U	**20 (1,2,3)**	1 U	**0.65 J**	1 U	**1.1**	1 U	**2.5 (3)**	1 U	**3 (2,3)**	1 U	1 U	**8.1 (1,2,3)**
Vinyl chloride (VC)	**2**	**0.015**	**0.02**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U
Xylene, total	10,000	**530**	**206**	1 U	1 U	**97**	**0.54 J**	**120**	**23**	**1.5**	**5.9**	**660 (2,3)**	**170**	**16**	**15**	5 U

Notes and Abbreviations:

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- **Detections that exceed one or more screening values are indicated by bold red font.**
- **Detections that exceed the NC2L Groundwater Standards are indicated by bold blue font (and potentially other screening values [i.e., blue font subsumes red font]).**
- Background value is two times the average background concentration as reported in Table 5-2.
- MCL - Maximum Contaminant Level (refer to Section 5.1.4)
- NC2L - 'Class GA' groundwater quality criteria as defined in the North Carolina Administrative Code, Title 15A, Chapter 2, Subchapter 2L (refer to Section 5.1.4)
- PRG - Preliminary Remediation Goal (refer to Section 5.1.4)

mg/L - milligrams per liter µg/L - micrograms per liter NA - Not Analyzed

U - Not detected above associated value

J - Estimated value below practical quantitation limit, but above method detection limit

Table 5-7
Grab Groundwater Detections
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station Identification	MCL-Groundwater (1)	NC2L Groundwater Standard (2)	USEPA Region 9 PRG Tap Water (3)	OU14-90GW02				OU14-90GW04			OU14-90GW04		OU14-90GW05
Sample Identification				OU14-90GW02-2025-05B	OU14-90GW02-3035-05B	OU14-90GW02-3540-05B	OU14-90GW02-4045-05B	OU14-90GW04-1520-05B	OU14-90GW04-2025-05B	OU14-90GW04-3035-05B	OU14-90GW04-3540-05B	OU14-90GW04-4045-05B	OU14-90GW05-1520-05B
Sample Date				04/13/05	04/13/05	04/13/05	04/13/05	04/13/05	04/13/05	04/13/05	04/13/05	04/13/05	04/12/05
Chemical Name													
VOCs (µg/L)													
1,1-Dichloroethane (1,1-DCA)	none	70	810	**5.4**	**10**	**4.8 J**	**4.5 J**	5 U	5 U	5 U	**3.2 J**	**32**	5 U
1,1-Dichloroethene	7	7	340	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	70	70	190	5 U	5 U	5 U	5 U	**3.3 J**	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane (1,2-DCA)	5	0.38	0.12	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**2.2 J (2,3)**	5 U
2-Butanone	none	4,200	7,000	13 U	13 U	13 U	13 U	**22**	13 U	13 U	13 U	13 U	**2.9 J**
2-Hexanone	none	280	none	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U
4-Methyl-2-pentanone (MIBK)	none	none	2,000	13 U	13 U	13 U	13 U	**6.6 J**	13 U	13 U	13 U	13 U	13 U
Acetone	none	700	5,500	13 U	13 U	13 U	13 U	**140**	13 U	13 U	**3 J**	**7.8 J**	**11 J**
Benzene	5	1	0.34	**1.2 J (2,3)**	5 U	5 U	5 U	**34 (1,2,3)**	**5.9 (1,2,3)**	**5.2 (1,2,3)**	**48 (1,2,3)**	**120 (1,2,3)**	5 U
Carbon disulfide	none	700	1,000	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	none	2,800	4.6	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	80	70	0.2	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	none	2.6	160	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 U
cis-1,2-Dichloroethene	70	70	61	**19**	**0.45 J**	5 U	**0.34 J**	5 U	**2.9 J**	**4.2 J**	**61**	**190 (1,2,3)**	**1.5 J**
Cumene (isopropylbenzene)	none	70	660	5 U	5 U	5 U	5 U	**20**	**2.3 J**	**2.2 J**	**8.7**	**5.7**	5 U
Cyclohexane	none	none	10,300	5 U	5 U	5 U	5 U	**3.1 J**	**1.6 J**	**32**	**13**	**12**	5 U
Ethylbenzene	700	550	1,340	5 U	5 U	5 U	5 U	**95**	**2.5 J**	**1.9 J**	**21**	**30**	5 U
Methylcyclohexane	none	none	5,200	5 U	5 U	5 U	5 U	**4.7 J**	**1.6 J**	**5.8**	**3.3 J**	**1.1 J**	5 U
Methylene chloride	5	4.6	4.3	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl-tert-butyl ether (MTBE)	none	200	11	5 U	5 U	5 U	5 U	5 U	**87 J (3)**	5 U	**1.2 J**	**3 J**	5 U
Styrene	100	100	1,600	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	1,000	1,000	720	5 U	5 U	5 U	5 U	**56**	5 U	5 U	5 U	**1.8 J**	5 U
trans-1,2-Dichloroethene	100	100	120	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**1 J**	**1.9 J**	5 U
Trichloroethene (TCE)	5	2.8	1.4	**1.7 J (3)**	5 U	**0.49 J**	**1.6 J (3)**	5 U	**11 (1,2,3)**	**13 (1,2,3)**	**37 (1,2,3)**	**11 (1,2,3)**	**1.5 J (3)**
Vinyl chloride (VC)	2	0.015	0.02	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	**5.7 (1,2,3)**	2 U
Xylene, total	10,000	530	206	5 U	5 U	5 U	5 U	**300 (3)**	**11**	5 U	**1.1 J**	**1.4 J**	5 U

Notes and Abbreviations:

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- MCL - Maximum Contaminant Level (refer to Section 5.1.4)
- NC2L - 'Class GA' groundwater quality criteria as defined in the North Carolina Administrative Code, Title 15A, Chapter 2, Subchapter 2L (refer to Section 5.1.4)
- PRG - Preliminary Remediation Goal (refer to Section 5.1.4)

mg/L - milligrams per liter µg/L - micrograms per liter NA - Not Analyzed

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Table 5-7
Grab Groundwater Detections
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station Identification	MCL-Groundwater (1)	NC2L Groundwater Standard (2)	USEPA Region 9 PRG Tap Water (3)	OU14-90GW05				OU14-90GW09			OU14-90GW09	OU14-90GW13	
Sample Identification				OU14-90GW05-2025-05B	OU14-90GW05-3035-05B	OU14-90GW05-3540-05B	OU14-90GW05-4045-05B	OU14-90GW09-1520-05B	OU14-90GW09-2025-05B	OU14-90GW09-3035-05B	OU14-90GW09-4045-05B	OU14-90GW13-1216-05B	OU14-90GW13-1621-05B
Sample Date				04/12/05	04/12/05	04/12/05	04/12/05	04/11/05	04/11/05	04/11/05	04/11/05	04/13/05	04/13/05
Chemical Name													
VOCs (µg/L)													
1,1-Dichloroethane (1,1-DCA)	none	**70**	810	5 U	5 U	5 U	5 U	5 U	5 U	**2.7 J**	**2 J**	5 U	5 U
1,1-Dichloroethene	**7**	**7**	340	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	70	70	190	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane (1,2-DCA)	**5**	**0.38**	**0.12**	5 U	**1.2 J (2,3)**	**2.8 J (2,3)**	**6.3 (1,2,3)**	5 U	5 U	5 U	**1.1 J (2,3)**	5 U	5 U
2-Butanone	none	4,200	7,000	13 U	13 U	13 U	**15**	13 U	13 U	13 U	13 U	13 U	13 U
2-Hexanone	none	280	none	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U
4-Methyl-2-pentanone (MIBK)	none	none	2,000	13 U	13 U	13 U	**13 U**	13 U	13 U	13 U	13 U	13 U	13 U
Acetone	none	700	5,500	13 U	13 U	**6 J**	**31**	**4.4 J**	**4.9 J**	**3.1 J**	**12 J**	**3.2 J**	**2.6 J**
Benzene	**5**	**1**	**0.34**	5 U	5 U	5 U	5 U	5 U	**1.9 J (2,3)**	**2.4 J (2,3)**	5 U	5 U	5 U
Carbon disulfide	none	700	1,000	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**2.2 J**	5 U	5 U
Chloroethane	none	2,800	**4.6**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	80	70	**0.2**	5 U	5 U	5 U	**3.6 J (3)**	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	none	**2.6**	160	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 UJ
cis-1,2-Dichloroethene	**70**	**70**	**61**	**2.3 J**	**23**	**4.4 J**	5 U	5 U	**3.7 J**	**8.2**	5 U	5 U	5 U
Cumene (isopropylbenzene)	none	70	660	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**2.4 J**	5 U
Cyclohexane	none	none	10,300	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**1.1 J**	5 U
Ethylbenzene	700	550	1,340	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**1.4 J**	5 U	5 U
Methylcyclohexane	none	none	5,200	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methylene chloride	**5**	**4.6**	**4.3**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl-tert-butyl ether (MTBE)	none	200	**11**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Styrene	100	100	1,600	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	1,000	1,000	720	**1.1 J**	**1.9 J**	**1.4 J**	**2.6 J**	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,2-Dichloroethene	100	100	120	**1.4 J**	**4.5 J**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene (TCE)	**5**	**2.8**	1.4	**2.4 J (3)**	**2 J (3)**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl chloride (VC)	**2**	**0.015**	**0.02**	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Xylene, total	10,000	**530**	**206**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**2 J**	5 U	5 U

Notes and Abbreviations:

- Bold value indicates detection
- The highest detected value (or lowest detection limit for nondetect) was selected for parent/duplicate sample pairs.
- Each screening criteria has been assigned a reference number listed in parentheses in the column header. The reference number is used to identify specific criteria exceeded in a particular sample. Refer to Section 5.1.4 for discussion of screening criteria.
- **Detections that exceed one or more screening values are indicated by bold red font.**
- **Detections that exceed the NC2L Groundwater Standards are indicated by bold blue font (and potentially other screening values [i.e., blue font subsumes red font]).**
- Background value is two times the average background concentration as reported in Table 5-2.
- MCL - Maximum Contaminant Level (refer to Section 5.1.4)
- NC2L - 'Class GA' groundwater quality criteria as defined in the North Carolina Administrative Code, Title 15A, Chapter 2, Subchapter 2L (refer to Section 5.1.4)
- PRG - Preliminary Remediation Goal (refer to Section 5.1.4)

mg/L - milligrams per liter µg/L - micrograms per liter NA - Not Analyzed

U - Not detected above associated value

J - Estimated value below practical quantitation limit, but above method detection limit

Table 5-7
Grab Groundwater Detections
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station Identification	MCL-Groundwater (1)	NC2L Groundwater Standard (2)	USEPA Region 9 PRG Tap Water (3)	OU14-90GW13			OU14-90GW15					OU14-90GW16	
Sample Identification				OU14-90GW13-2631-05B	OU14-90GW13-3136-05B	OU14-90GW13-3641-05B	OU14-90GW15-1318-05B	OU14-90GW15-1823-05B	OU14-90GW15-2328-05B	OU14-90GW15-2833-05B	OU14-90GW15-3338-05B	OU14-90GW16-1621-05B	OU14-90GW16-2631-05B
Sample Date				04/13/05	04/13/05	04/13/05	04/12/05	04/12/05	04/12/05	04/12/05	04/12/05	04/12/05	04/12/05
Chemical Name													
VOCs (µg/L)													
1,1-Dichloroethane (1,1-DCA)	none	**70**	810	5 U	**1.8 J**	**29**	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethene	**7**	**7**	340	5 U	5 U	**2.6 J**	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	70	70	190	5 U	5 U	5 U	**3.3 J**	**3.8 J**	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane (1,2-DCA)	**5**	**0.38**	**0.12**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	none	4,200	7,000	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	**2.9 J**	13 U
2-Hexanone	none	280	none	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U
4-Methyl-2-pentanone (MIBK)	none	none	2,000	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U
Acetone	none	700	5,500	13 U	**2.8 J**	13 U	13 U	**4.1 J**	13 U	**3.9 J**	13 U	**6.2 J**	**2.6 J**
Benzene	**5**	**1**	**0.34**	5 U	**2.5 J (2,3)**	**7.7 (1,2,3)**	**160 (1,2,3)**	**1.7 J (2,3)**	**10 (1,2,3)**	**1.4 J (2,3)**	5 U	5 U	5 U
Carbon disulfide	none	700	1,000	5 U	5 U	5 U	5 U	**1.5 J**	5 U	**2.4 J**	**1.3 J**	**1.2 J**	5 U
Chloroethane	none	2,800	**4.6**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	80	70	**0.2**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**2.1 J (3)**	5 U
Chloromethane	none	**2.6**	160	5 UJ	5 UJ	5 UJ	5 UJ	5 U	5 UJ	5 UJ	5 UJ	5 U	5 UJ
cis-1,2-Dichloroethene	**70**	**70**	**61**	**5.5**	**49**	**1,800 (1,2,3)**	5 U	5 U	5 U	**3 J**	5 U	5 U	5 U
Cumene (isopropylbenzene)	none	70	660	5 U	5 U	5 U	**69**	**1.9 J**	**13**	5 U	5 U	5 U	5 U
Cyclohexane	none	none	10,300	5 U	5 U	5 U	**180**	**11**	**94**	5 U	5 U	5 U	5 U
Ethylbenzene	700	550	1,340	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methylcyclohexane	none	none	5,200	5 U	5 U	5 U	**170**	**7.9**	**82**	5 U	5 U	5 U	5 U
Methylene chloride	**5**	**4.6**	**4.3**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl-tert-butyl ether (MTBE)	none	200	**11**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Styrene	100	100	1,600	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	1,000	1,000	720	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,2-Dichloroethene	100	100	120	5 U	5 U	**12**	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene (TCE)	**5**	**2.8**	1.4	5 U	**4.1 J (2,3)**	**30 (1,2,3)**	**1.1 J**	5 U	**2.3 J (3)**	**17 (1,2,3)**	**1.9 J (3)**	5 U	**1.1 J**
Vinyl chloride (VC)	**2**	**0.015**	**0.02**	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Xylene, total	10,000	**530**	**206**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U

Notes and Abbreviations:

- Bold value indicates detection
- The highest detected value (or lowest detection limit for nondetect) was selected for parent/duplicate sample pairs.
- Each screening criteria has been assigned a reference number listed in parentheses in the column header. The reference number is used to identify specific criteria exceeded in a particular sample. Refer to Section 5.1.4 for discussion of screening criteria.
- **Detections that exceed one or more screening values are indicated by bold red font.**
- **Detections that exceed the NC2L Groundwater Standards are indicated by bold blue font (and potentially other screening values [i.e., blue font subsumes red font]).**
- Background value is two times the average background concentration as reported in Table 5-2.
- MCL - Maximum Contaminant Level (refer to Section 5.1.4)
- NC2L - 'Class GA' groundwater quality criteria as defined in the North Carolina Administrative Code, Title 15A, Chapter 2, Subchapter 2L (refer to Section 5.1.4)
- PRG - Preliminary Remediation Goal (refer to Section 5.1.4)

mg/L - milligrams per liter µg/L - micrograms per liter NA - Not Analyzed

U - Not detected above associated value

J - Estimated value below practical quantitation limit, but above method detection limit

Table 5-7
Grab Groundwater Detections
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station Identification	MCL-Groundwater (1)	NC2L Groundwater Standard (2)	USEPA Region 9 PRG Tap Water (3)	OU14-90GW16			OU14-90GW18				
Sample Identification				OU14-90GW16-3136-05B	OU14-90GW16-3641-05B	OU14-90GW16-2126-05B	OU14-90GW18-1520-05B	OU14-90GW18-2025-05B	OU14-90GW18-2530-05B	OU14-90GW18-3035-05B	OU14-90GW18-3540-05B
Sample Date				04/12/05	04/12/05	04/21/05	04/11/05	04/11/05	04/11/05	04/11/05	04/11/05
Chemical Name											
VOCs (µg/L)											
1,1-Dichloroethane (1,1-DCA)	none	**70**	810	5 U	5 U	5 U	5 U	5 U	**5.9**	**18**	**46**
1,1-Dichloroethene	**7**	**7**	340	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**1.5 J**
1,2,4-Trichlorobenzene	70	70	190	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane (1,2-DCA)	**5**	**0.38**	**0.12**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	none	4,200	7,000	**21**	**6.7 J**	13 U	13 U	13 U	13 U	13 U	13 U
2-Hexanone	none	280	none	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U
4-Methyl-2-pentanone (MIBK)	none	none	2,000	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U
Acetone	none	700	5,500	**59**	**15**	**4.9 J**	**11 J**	**4.6 J**	**2.7 J**	**7 J**	**4 J**
Benzene	**5**	**1**	**0.34**	5 U	5 U	5 U	5 U	5 U	**1.1 J (2,3)**	**3.4 J (2,3)**	**5.5 (1,2,3)**
Carbon disulfide	none	700	1,000	5 U	5 U	5 U	**1.7 J**	**1.3 J**	5 U	5 U	5 U
Chloroethane	none	2,800	**4.6**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	80	70	**0.2**	**5.8 (3)**	5 U	**1 J (3)**	**1.1 J (3)**	5 U	5 U	5 U	5 U
Chloromethane	none	**2.6**	160	5 UJ	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	**70**	**70**	**61**	5 U	5 U	5 U	5 U	5 U	**9.5**	**51**	**99 (1,2,3)**
Cumene (isopropylbenzene)	none	70	660	5 U	5 U	5 U	5 U	5 U	5 U	**4.2 J**	**3.3 J**
Cyclohexane	none	none	10,300	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	700	550	1,340	5 U	5 U	5 U	5 U	5 U	5 U	**8.3**	**7.7**
Methylcyclohexane	none	none	5,200	5 U	5 U	5 U	5 U	5 U	5 U	**2.6 J**	**1.5 J**
Methylene chloride	**5**	**4.6**	**4.3**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl-tert-butyl ether (MTBE)	none	200	**11**	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Styrene	100	100	1,600	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	1,000	1,000	720	**1.5 J**	**1.7 J**	**1.2 J**	5 U	5 U	5 U	5 U	5 U
trans-1,2-Dichloroethene	100	100	120	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene (TCE)	**5**	**2.8**	1.4	**4.3 J (2,3)**	**1.4 J**	5 U	5 U	5 U	5 U	**1.2 J**	**1.5 J (3)**
Vinyl chloride (VC)	**2**	**0.015**	**0.02**	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Xylene, total	10,000	**530**	**206**	5 U	5 U	5 U	5 U	5 U	5 U	**25**	**25**

Notes and Abbreviations:

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- Each screening criteria has been assigned a reference number listed in parentheses in the column header. The reference number is used to identify specific criteria exceeded in a particular sample. Refer to Section 5.1.4 for discussion of screening criteria.
- **Detections that exceed one or more screening values are indicated by bold red font.**
- **Detections that exceed the NC2L Groundwater Standards are indicated by bold blue font (and potentially other screening values [i.e., blue font subsumes red font]).**
- Background value is two times the average background concentration as reported in Table 5-2.
- MCL - Maximum Contaminant Level (refer to Section 5.1.4)
- NC2L - 'Class GA' groundwater quality criteria as defined in the North Carolina Administrative Code, Title 15A, Chapter 2, Subchapter 2L (refer to Section 5.1.4)
- PRG - Preliminary Remediation Goal (refer to Section 5.1.4)

mg/L - milligrams per liter µg/L - micrograms per liter NA - Not Analyzed

U - Not detected above associated value

J - Estimated value below practical quantitation limit, but above method detection limit

Table 5-8
Surface Water Detections
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station Identification	NC2B Class C Surface Water Standard (1)	USEPA Region 9 PRG Tap Water (2)	USEPA Region 4 Freshwater - Chronic (3)	BTAG Freshwater-Fauna (4)	BTAG Freshwater-Flora (5)	(Upstream Lined Channel) OU14-SD01/SW01	OU14-SD02/SW02	OU14-SD03/SW03	OU14-SD04/SW04	OU14-SD05/SW05	OU14-SW06
Sample Identification						OU14-SW01-0406	OU14-SW02-0406	OU14-SW03-0406	OU14-SW04-0406	OU14-SW05-0406	OU14-SW06-0406[1]
Sample Date						04/25/06	04/25/06	04/25/06	04/25/06	04/25/06	04/25/06
Volatile Organic Compounds (µg/L)											
1,1-Dichloroethene	5,400**	340	303	11,600	798,000	0.5 U	0.5 U	0.5 U	**0.12 J**	0.5 U	0.5 U
Benzene	51	0.34	53	5,300	20,000	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	**0.16 J**
Bromoform	140**	8.5	293	11,000	none	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	**0.1 J**
Carbon disulfide	none	1,000	none	2	none	0.5 U	0.5 U	**0.12 J**	0.5 U	0.5 U	0.5 U
Cyclohexane	230**	10,300	none	none	none	0.5 U	0.5 U	0.5 U	**0.1 J**	0.5 U	**0.3 J**
Trichloroethene (TCE)	30	1.4	none	21,900	21,900	0.5 U	0.5 U	0.5 U	**0.12 J**	0.5 U	**0.19 J**
cis-1,2-Dichloroethene	4,900**	61	none	11,600	11,600	0.5 U	**0.15 J**	**0.25 J**	**0.39 J**	0.5 U	**0.5**
Total Metals (µg/L)											
Arsenic	10	**0.045**	190	190	48	1.6 U	**2.4 J (2)**	**2.9 J (2)**	**3.5 J (2)**	1.6 U	**5.5 J (2)**
Barium	200,000**	2,600	none	10,000	10,000	**31 J**	**34.8 J**	34.4 J	**36.8 J**	**10.6 J**	**38.2 J**
Dissolved Metals (µg/L)											
Barium	200,000**	2,600	none	10,000	10,000	**30 J**	**30.8 J**	**31.2 J**	**32.4 J**	**8.2 J**	**31.8 J**
Lead	25	none	1.32	3.2	none	1 U	**1.1 J**	1 U	1 U	1 U	1 U
Selenium	5	180	5	5	522	**2 J**	**2.1 J**	1.8 U	1.8 U	1.8 U	1.8 U
Wet Chemistry (mg/L)											
Hardness	none	none	none	none	none	**118**	**117**	**120**	**107**	**92.6**	**131**

Notes and Abbreviations:

- Bold value indicates detection
- The highest detected value (or lowest detection limit for nondetect) was selected for parent/duplicate sample pairs.
- Each screening criteria has been assigned a reference number listed in parentheses in the column header. The reference number is used to identify specific criteria exceeded in a particular sample.
- **Detections that exceed one or more screening values are indicated by bold red font.**
- BTAG - Biological Technical Assistance Group
- NC2B Class C Surface Water Standard - 'Class C' values as defined in the NC Administrative Code, Title 15A, Chapter 2, Subchapter 2B.
  ** denotes non-NC2B National EPA surface water criteria applicable to surface water standards enforcement in NC when no NC2B value is available--as detailed in the August 2007 NC & EPA Surface Water Criteria Table located at:
  http://h2o.enr.state.nc.us/csu/documents/NC_EPA_Standards_CriteriaTables9-03-08.pdf.
- PRG - Preliminary Remediation Goal

mg/L - milligrams per liter µg/L - micrograms per liter NA - Not Analyzed

U - Not detected above associated value

J - Estimated value below practical quantitation limit, but above method detection limit

Table 5-9
Sediment Detections
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Station Identification	USEPA Region 9 PRGs - Residential Soil (1)	USEPA Region 4 - Sediment (2)	BTAG-Sediment Flora (3)	BTAG-Sediment Fauna (4)	2 x Background	(Upstream Lined Channel) OU14-SD01/SW01	OU14-SD02/SW02	OU14-SD03/SW03	OU14-SD04/SW04	OU14-SD05/SW05	OU14-SD06
Sample Identification						OU14-SD01-0406	OU14-SD02-0406	OU14-SD03-0406	OU14-SD04-0406	OU14-SD05-0406	OU14-SD06-0406
Sample Date						04/25/06	04/25/06	04/25/06	04/25/06	04/25/06	04/25/06
Volatile Organic Compounds (µg/kg)											
(No Detections)											
Total Metals (mg/kg)											
Arsenic	**0.39**	7.24	none	8.2	10,160	**1.3 (1)**	**2 (1)**	**2.5 (1)**	**1.7 (1)**	0.18 U	**0.27 J**
Barium	5,400	none	none	none	23	**5.7 J**	**3.6 J**	**4.8 J**	**16.3 J**	**2.9 J**	**29.9 J**
Cadmium	37	1	5.1	1.2	1.1	**0.08 J**	**0.06 J**	**0.05 J**	0.03 U	0.02 U	0.02 U
Chromium	210	52.3	**5**	260	17	**2.3**	**2.4**	**3**	**11 (3)**	**13.8 (3)**	**2**
Lead	400	30.2	none	46.7	10.5	**4**	**4.5**	**4.6**	**6.1**	**1.9**	**1.4 J**
Selenium	390	none	none	none	0.6	0.23 U	0.23 U	0.27 U	0.23 U	0.21 U	**0.23 J**
Wet Chemistry (mg/kg)											
Total organic carbon (TOC)	none	none	none	none	none	**7,550**	**5,580**	**11,200**	**6,010**	**1,680**	**2,940**
pH	none	none	none	none	none	**7.05**	**6.59**	**6.36**	**6.5**	**7.64**	**7.97**

Notes and Abbreviations:

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- Each screening criteria has been assigned a reference number listed in parentheses in the column header. The reference number is used to identify specific criteria exceeded in a particular sample. Refer to Section 5.1.4 for discussion of screening criteria.
- **Detections that exceed one or more screening values are indicated by bold red font.**
- BTAG - Biological Technical Assistance Group (refer to Section 5.1.4)
- PRG - Preliminary Remediation Goal (refer to Section 5.1.4)

mg/L - milligrams per liter µg/L - micrograms per liter NA - Not Analyzed

U - Not detected above associated value

J - Estimated value below practical quantitation limit, but above method detection limit

Table 6-1
Contaminants of Interest by Media
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Contaminants of Interest (COIs)	Monitoring Well Groundwater (Surficial Aquifer)	Subsurface Soil	Sediment	Surface Water
CVOCs				
1,1-Dichloroethane	x			
1,2-Dichloroethane	x			
cis-1,2-Dichloroethene	x			
Chloroemethane	x			
Methylene Chloride	x			
Tetrachloroethene	x			
Trichloroethene*	x			
Vinyl Chloride*	x (H)			
Non-Chlorinated VOCs				
Benzene*	x (H)	x		
Cumene	x			
Ethylbenzene		x		
Methyl-tert-butyl-ether (MTBE)	x			
Xylenes	x	x		
Inorganics				
Arsenic*	x (H)		x	x
Cadmium	x			
Chromium			x	
Iron	x			
Manganese	x			

Notes and Abbreviations

No exceedances occurred in the most recent groundwater samples from the Yorktown Aquifer.
x - analytes that exceed screening criteria
H - Human health risk driver (among other constituents that may contribute to risk)
E - Ecological risk driver
* Used as representative constituent in Table 6-2 to represent physical, chemical, and half-life properties.
COIs are identified to facilitate discussion of fate and transport of chemicals, some of which, but not necessarily all, will be identified as chemicals of concern (COCs) under the CERCLA process.

Table 6-2
Physical and Chemical Properties of Contaminants of Interest
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Constituent	Molecular Formula	Molecular Weight	Water Solubility (mg/L at 20 °C)	Vapor Pressure (mm Hg)	Specific Gravity (unitless)	Henry's Law Constant at 25 °C (atm-m³/mole)	K_d or Log K_{oc} (ml/g)	Half-Life Range (hours)					
								Soil		Groundwater		Surface Water	
								Low	High	Low	High	Low	High
Organics													
Benzene	C_6H_6	78.11 (1)	1,780 (5)	76 (5)	0.88 (5)	0.74	2.13	120 (2)	384 (2)	240 (2)	17,280 (2)	120 (2)	384 (2)
Trichloroethene	C_2HCl_3	131.4 (5)	1,100 @ 25ºC (5)	60 (5)	1.46 (5)	0.011 (1)	2.1 (1)	4,320 (2)	8,640 (2)	7,704 (2)	39,672 (2)	4,320 (2)	8,640 (2)
Vinyl Chloride	C_2H_3Cl	62.5 (5)	1.1 @ 25ºC (5)	660 (5)	0.91(5)	0.028 (1)	1.99 (1)	672 (2)	4320 (2)	1,344 (2)	69,000 (2)	672 (2)	4,320 (2)
Inorganic													
Arsenic	As	U	U	U	U	U	20-70 (4)	NP	NP	NP	NP	NP	NP

Notes and Abbreviations

Arsenic and benzene are not considered CERCLA-release-contaminants at OU14. However, they are discussed in this section due to their prevalence in OU14 groundwater (and benzene in soil).
mm Hg - millimeter of mercury
mg/L - milligram per liter
U - No value is provided because of the uncertainty in the form of these constituents in the environment
NA - Data not available
K_{oc} - Organic carbon partition coefficient
°C - Degrees Celsius
atm - atmosphere
m^3 - cubic meter
ml/g - milliliter per gram
Sources:
(1) Montgomery and Welkom (1989) *Groundwater Chemicals Desk Reference. Volume 1.*
(2) Howard et al. (1991) *Handbook of Environmental Degradation Rates.*
(3) Lide (2004) *Handbook of Chemistry and Physics, 85th Edition.*
(4) Dragun (1998) *The Soil Chemistry of Hazardous Materials, 2nd Edition.* [K_d estimates, not K_{oc}]
(5) Verschueren (1983) *Handbook of Environmental Data on Organic Chemicals.*

Table 6-3
Retardation Coefficients for Contaminants of Interest
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Chemical	Log K_{oc}	Low K_d	High K_d	Low R	High R
Organics					
Benzene	2.13	8.6E-04	--	1.0064	--
Trichloroethene	2.1	8.1E-04	--	1.0060	--
Vinyl Chloride	1.99	6.3E-04	--	1.0046	--
Inorganic					
$Arsenic^{+3}$ (arsenite)	NA	1	8.3	8	62
$Arsenic^{+5}$ (arsenate)	NA	2	18	15	134

Notes and Abbreviations

K_{oc} = Organic carbon partition coefficient
K_d = Distribution coefficient
R = Retardation coefficient = $1 + K_d \times p_b / n_e$
p_b = Soil bulk density = 1.85 g/cm^3
n_e = Effective porosity = 0.25
-- = Only one K_d and R value calculated
NA = Not applicable; K_d provided
For organics, $K_d = K_{oc}$ x fraction of organic carbon (approximately 0.0000064)
Arsenic and benzene are not considered CERCLA-release-contaminants at OU14.
However, they are discussed in this section due to their prevalence in OU14 groundwater (and benzene in soil).

Sources:
(1) Montgomery and Welkom (1989) *Groundwater Chemicals Desk Reference. Volume 1.*
(2) Baes and Sharp (1983) "A proposal for estimation of soil leaching…" *Journal of Enviornmental Quality*
(3) Dragun (1998) *The Soil Chemistry of Hazardous Materials, 2nd Edition.* [K_d estimates, not K_{oc}]
(4) Verschueren (1983) *Handbook of Environmental Data on Organic Chemicals.*

Table 6-4
Summary of BIOCHLOR Inputs and Calibration
Upper Surficial Aquifer, Building 4075 Source Area
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Input Parameters

Parameter	Value	Units	Basis
Hydraulic Conductivity	0.016	cm/sec	Measured
Hydraulic Gradient	0.003	ft/ft	Calculated from site data
Effective Porosity	-	-	Typical of site soils; model calibration
Longitudinal Dispersivity	21.952	ft	Calculated from estimated plume length using Xu and Eckstein equation
Transverse Dispersivity Ratio	0.1	-	Default
Vertical Dispersivity Ratio	1.E-02	-	Conservatively assumes little vertical dispersion
Soil Bulk Density	1.6	kg/L	Typical of site soils; model calibration
Fraction Organic Carbon	0.0001	-	Typical of site soils; model calibration
PCE Partition Coefficient	426	L/kg	BIOCHLOR Default Value
TCE Partition Coefficient	130	L/kg	BIOCHLOR Default Value
DCE Partition Coefficient	125	L/kg	BIOCHLOR Default Value
VC Partition Coefficient	30	L/kg	BIOCHLOR Default Value
Ethene Partition Coefficient	302	L/kg	BIOCHLOR Default Value
TCE Half-Life	1	years	Literature values; model calibration
DCE Half-Life	0.3	years	Literature values; model calibration
VC Half-Life	0.05	years	Literature values; model calibration
Simulation Time	60	years	Release date of 1945 based on site history; model calibration
Model Area Width	200	ft	Potential plume width
Modeled Area Length	900	ft	Distance along plume centerline from source to unnamed stream
Source Thickness in Saturated Zone	15	ft	Estimated based on site conditions; model calibration
Width	110	ft	Estimated source width; model calibration
Source Area Decay Rate	0.02	1/yr	Estimated based on historical data; model calibration
Initial TCE Concentration	600	µg/L	Estimated based on site conditions; model calibration
Initial DCE Concentration	100	µg/L	Estimated based on site conditions; model calibration
Initial VC Concentration	0	µg/L	Estimated based on site conditions; model calibration

Model Calibration

		TCE		DCE		VC	
Well ID	Distance from Source Area (ft)	Model Predicted (µg/L)	Actual (µg/L)	Model Predicted (µg/L)	Actual (µg/L)	Model Predicted (µg/L)	Actual (µg/L)
56GW02	Source	180.7	180	30.1	30	0	<2
90GW06	545	22	8.5	7	<5	1	<2
66GW47	763	10	13	3	3.3	0	<2

Notes:
TCE = Trichloroethene; DCE = cis-1,2-Dichloroethene; VC = Vinyl Chloride
Actual Concentrations based on data collected in April 2005.

Table 6-5
Summary of BIOCHLOR Inputs and Calibration
Lower Surficial Aquifer, Building 130 Source Area
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Input Parameters

Parameter	Value	Units	Basis
Hydraulic Conductivity	0.0024	cm/sec	Measured; model calibration
Hydraulic Gradient	0.004	ft/ft	Calculated from site data
Effective Porosity	0.2	-	Typical of site soils; model calibration
Longitudinal Dispersivity	24.905	ft	Calculated from estimated plume length using Xu and Eckstein equation
Transverse Dispersivity Ratio	0.1	-	Default; model calibration
Vertical Dispersivity Ratio	1.E-99	-	Conservatively assumes little vertical dispersion
Soil Bulk Density	1.6	kg/L	Typical of site soils; model calibration
Fraction Organic Carbon	0.0001	-	Typical of site soils; model calibration
PCE Partition Coefficient	426	L/kg	BIOCHLOR Default Value
TCE Partition Coefficient	130	L/kg	BIOCHLOR Default Value
DCE Partition Coefficient	125	L/kg	BIOCHLOR Default Value
VC Partition Coefficient	30	L/kg	BIOCHLOR Default Value
Ethene Partition Coefficient	302	L/kg	BIOCHLOR Default Value
TCE Half-Life	6	years	Literature values; model calibration
DCE Half-Life	7.0	years	Literature values; model calibration
VC Half-Life	0.2	years	Literature values; model calibration
Simulation Time	60	years	Release date of 1945 based on site history; model calibration
Model Area Width	1000	ft	Potential plume width
Modeled Area Length	3000	ft	Potential Plume length along centerline
Source Thickness in Saturated Zone	30	ft	Estimated based on site conditions; model calibration
Width	110	ft	Estimated source width; model calibration
Source Area Decay Rate	0.1	1/yr	Estimated based on historical data; model calibration
Initial TCE Concentration	8,000	µg/L	Estimated based on site conditions; model calibration
Initial DCE Concentration	35,000	µg/L	Estimated based on site conditions; model calibration
Initial VC Concentration	0	µg/L	Estimated based on site conditions; model calibration

Model Calibration

		TCE		DCE		VC	
Well ID	Distance from Source Area (ft)	Model Predicted (µg/L)	Actual (µg/L)	Model Predicted (µg/L)	Actual (µg/L)	Model Predicted (µg/L)	Actual (µg/L)
72GW19	Source	19.8	19	86.8	92	0	<2
13GW144	870	11	11	82	51	2	<2
13GW29	981	10	<5	82	98	2	2

Notes:
TCE = Trichloroethene; DCE = cis-1,2-Dichloroethene; VC = Vinyl Chloride
Actual Concentrations based on data collected in April 2005.

Table 6-6
Summary of BIOCHLOR Inputs and Calibration
Lower Surficial Aquifer, Former Refueling Station Source Area
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Input Parameters

Parameter	Value	Units	Basis
Hydraulic Conductivity	0.003	cm/sec	Measured; model calibration
Hydraulic Gradient	0.004	ft/ft	Calculated from site data
Effective Porosity	0.2	-	Typical of site soils; model calibration
Longitudinal Dispersivity	7.5566	ft	Calculated from estimated plume length using Xu and Eckstein equation
Transverse Dispersivity Ratio	0.1	-	Model calibration
Vertical Dispersivity Ratio	1.E-99	-	Conservatively assumes little vertical dispersion
Soil Bulk Density	1.6	kg/L	Typical of site soils; model calibration
Fraction Organic Carbon	0.0001	-	Typical of site soils; model calibration
PCE Partition Coefficient	426	L/kg	BIOCHLOR Default Value
TCE Partition Coefficient	130	L/kg	BIOCHLOR Default Value
DCE Partition Coefficient	125	L/kg	BIOCHLOR Default Value
VC Partition Coefficient	30	L/kg	BIOCHLOR Default Value
Ethene Partition Coefficient	302	L/kg	BIOCHLOR Default Value
TCE Half-Life	1.50	years	Literature values; model calibration
DCE Half-Life	0.25	years	Literature values; model calibration
VC Half-Life	1.00	years	Literature values; model calibration
Simulation Time	60	years	Release date of 1950 based on site history; model calibration
Model Area Width	500	ft	Potential Plume Width
Modeled Area Length	800	ft	Distance along plume centerline from source to Unnamed Stream
Source Thickness in Saturated Zone	30	ft	Estimated based on site conditions; model calibration
Width	110	ft	Estimated source width; model calibration
Source Area Decay Rate	0.1	1/yr	Estimated based on historical data; model calibration
Initial TCE Concentration	6,000	µg/L	Estimated based on site conditions; model calibration
Initial DCE Concentration	50	µg/L	Estimated based on site conditions; model calibration
Initial VC Concentration	1	µg/L	Estimated based on site conditions; model calibration

Model Calibration Slocum Creek Flow Path

		TCE		DCE		VC	
Well ID	Distance from Source Area (ft)	Model Predicted (µg/L)	Actual (µg/L)	Model Predicted (µg/L)	Actual (µg/L)	Model Predicted (µg/L)	Actual (µg/L)
56GW09	Source	14.9	15	0.1	<5	0	<2
90GW15	240	5	1.8	1	<5	2	<2
66GW46	523	1	1.4	0	<5	1	<2

Notes:
TCE = Trichloroethene; DCE = cis-1,2-Dichloroethene; VC = Vinyl Chloride
Actual Concentrations based on data collected in April 2005.

Table 6-7
Summary of NAS Inputs
Upper Surficial Aquifer, Building 4075 Source Area
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Hydrogeologic Data and Contaminant Transport Calculations						
	Maximum	Average	Minimum	NAPL Source Length [ft]		110
Hydr. Conductivity [ft/d]	60	45	30	NAPL Source Width [ft]		110
Hydraulic Gradient [ft/ft]	0.005	0.003	0.001	Contaminated Aquifer Thickness [ft]		15
Total Porosity [-]		0.35				
Effective Porosity [-]		0.2				
Groundwater Vel. [ft/d]	1.5	0.675	0.15			

Sorption Parameters				
Fraction Org. Carbon [-]				
Maximum	0.001			
Average	0.0001			
Minimum	0.00001			
	Total Chl. Eth.	TCE	cis-DCE	Vinyl Chl.
Koc [L/kg]	126	130	125	30
Retardation Factor [-]				
Maximum	1.01	1.01	1.01	1
Average	1	1	1	1
Minimum	1	1	1	1

Contaminant Concentration Profiles (4/21/2005)					
	Distance	Total Chl. Eth.	TCE	cis-DCE	Vinyl Chl.
Well Name	[ft]	[µg/L]	[µg/L]	[µg/L]	[µg/L]
56GW02	0	210	180	30	BD
90GW06	545	8.5	8.5	BD	BD
66GW47	763	16.3	13	3.3	BD

Redox Indicator Concentration Profiles (4/21/2005)							
	Distance	Oxygen	Nitrate	Iron(II)	Sulfate	Methane	Redox
Well Name	[ft]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	Condition
56GW02	0	BD	0.435	NS	39	0.69	SO4/CO2-red.
90GW06	545	BD	0.115	NS	58.7	BD	SO4/CO2-red.
66GW47	763	0.26	BD	NS	64	0.033	SO4/CO2-red.

Notes:
TCE = Trichloroethene; DCE = cis-1,2-Dichloroethene; VC = Vinyl Chloride

Table 6-8
Summary of NAS Inputs
Lower Surficial Aquifer, Building 130 Source Area
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Hydrogeologic Data and Contaminant Transport Calculations						
	Maximum	Average	Minimum			
Hydr. Conductivity [ft/d]	10	7	3	NAPL Source Length [ft]		100
Hydraulic Gradient [ft/ft]	0.006	0.004	0.001	NAPL Source Width [ft]		110
Total Porosity [-]		0.35		Contaminated Aquifer Thickness [ft]		30.0
Effective Porosity [-]		0.2				
Groundwater Vel. [ft/d]	0.3	0.14	0.015			

Sorption Parameters				
Fraction Org. Carbon [-]				
Maximum	0.001			
Average	0.0001			
Minimum	0.00001			
	Total Chl. Eth.	TCE	cis-DCE	Vinyl Chl.
Koc [L/kg]	126	130	125	30
Retardation Factor [-]				
Maximum	1.01	1.01	1.01	1
Average	1	1	1	1
Minimum	1	1	1	1

Contaminant Concentration Profiles (4/21/2005)					
	Distance	Total Chl. Eth.	TCE	cis-DCE	Vinyl Chl.
Well Name	[ft]	[µg/L]	[µg/L]	[µg/L]	[µg/L]
72GW19	0	111	19	92	BD
13GW143	870	62	11	51	BD
13GW29	981	100.3	BD	98	2.3

Redox Indicator Concentration Profiles (4/21/2005)							
	Distance	Oxygen	Nitrate	Iron(II)	Sulfate	Methane	Redox
Well Name	[ft]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	Condition
72GW19	0	BD	0.04	NS	122	0.051	SO4/CO2-red.
13GW143	870	0.32	NS	NS	NS	NS	SO4/CO2-red.
13GW29	981	1.55	NS	NS	NS	NS	SO4/CO2-red.

Notes:
TCE = Trichloroethene; DCE = cis-1,2-Dichloroethene; VC = Vinyl Chloride

Table 6-9
Summary of NAS Inputs
Lower Surficial Aquifer, Former Refueling Station Source Area
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Hydrogeologic Data and Contaminant Transport Calculations						
	Maximum	Average	Minimum			
Hydr. Conductivity [ft/d]	10	7	3	NAPL Source Length [ft]		100
Hydraulic Gradient [ft/ft]	0.006	0.004	0.001	NAPL Source Width [ft]		110
Total Porosity [-]		0.35		Contaminated Aquifer Thickness [ft]		30.0
Effective Porosity [-]		0.2				
Groundwater Vel. [ft/d]	0.3	0.14	0.015			

Sorption Parameters				
Fraction Org. Carbon [-]				
Maximum	0.001			
Average	0.0001			
Minimum	0.00001			
	Total Chl. Eth.	TCE	cis-DCE	Vinyl Chl.
Koc [L/kg]	126	130	125	30
Retardation Factor [-]				
Maximum	1.01	1.01	1.01	1
Average	1	1	1	1
Minimum	1	1	1	1

Contaminant Concentration Profiles (4/21/2005)					
	Distance	Total Chl. Eth.	TCE	cis-DCE	Vinyl Chl.
Well Name	[ft]	[µg/L]	[µg/L]	[µg/L]	[µg/L]
56GW09	0	15	15	BD	BD
90GW15	240	1.8	1.8	BD	BD
66GW46	523	1.4	1.4	BD	BD

Redox Indicator Concentration Profiles (4/21/2005)							
	Distance	Oxygen	Nitrate	Iron(II)	Sulfate	Methane	Redox
Well Name	[ft]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	Condition
56GW09	0	BD	NS	NS	NS	NS	Ferrogenic
90GW15	240	BD	NS	NS	NS	NS	Ferrogenic
66GW46	523	1.96	0.02	NS	23	0.077	Suboxic

Notes:
TCE = Trichloroethene; DCE = cis-1,2-Dichloroethene; VC = Vinyl Chloride

Table 6-10
Summary of BIOCHLOR Prediction
Upper Surficial Aquifer, Building 4075 Source Area
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

TCE (Initial Source Concentration 600 µg/L)

Date	Maximum Concentration (µg/L)	Distance from Source of Maximum Concentration (ft)	Maximum Plume Extent (ft)	Concentration at Unnamed Stream (µg/L)
2055	66.5	Source	870	Below SW Standard
2105	24.5	Source	590	Below SW Standard
2155	9	Source	330	Below SW Standard
2215	Below GW Standard	Below GW Standard	Below GW Standard	Below SW Standard

cis-1,2-DCE (Initial Source Concentration 100 µg/L)

Date	Maximum Concentration (µg/L)	Distance from Source of Maximum Concentration (ft)	Maximum Plume Extent (ft)	Concentration at Unnamed Stream (µg/L)
2055	Below GW Standard	Below GW Standard	Below GW Standard	Below SW Standard
2105	Below GW Standard	Below GW Standard	Below GW Standard	Below SW Standard
2155	Below GW Standard	Below GW Standard	Below GW Standard	Below SW Standard
2215	Below GW Standard	Below GW Standard	Below GW Standard	Below SW Standard

VC (Initial Source Concentration 0 µg/L)

Date	Maximum Concentration (µg/L)	Distance from Source of Maximum Concentration (ft)	Maximum Plume Extent (ft)	Concentration at Unnamed Stream (µg/L)
2055	1	40	380	Below SW Standard
2105	Below GW Standard	Below GW Standard	Below GW Standard	Below SW Standard
2155	Below GW Standard	Below GW Standard	Below GW Standard	Below SW Standard
2215	Below GW Standard	Below GW Standard	Below GW Standard	Below SW Standard

Notes:
TCE = Trichloroethene, cis-1,2-DCE = cis-1,2-dichloroethene, VC = vinyl chloride
"SW Standard" refers to the NC2B, "Class C," Surface Water Standard: TCE = 30 µg/L (NC2B), cis-1,2-DCE = 4,900 µg/L (ECOTOX & RAIS), and VC = 2.4 µg/L (NC2B)
"GW Standard" refers to the NC2L Groundwater Standard: TCE = 2.8 µg/L, cis-1,2-DCE = 70 µg/L, and VC = 0.015 µg/L

Table 6-11
Summary of BIOCHLOR Prediction
Lower Surficial Aquifer, Building 130 Source Area
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

TCE (Initial Source Concentration 8,000 µg/L)

Date	Maximum Concentration (µg/L)	Distance from Source of Maximum Concentration (ft)	Maximum Plume Extent (ft)	Concentration at Unnamed Stream (µg/L)
2015	7.3	Source	1,970	Below SW Standard
2025	Below GW Standard	Below GW Standard	Below GW Standard	Below SW Standard

cis-1,2-DCE (Initial Source Concentration 35,000 µg/L)

Date	Maximum Concentration (µg/L)	Distance from Source of Maximum Concentration (ft)	Maximum Plume Extent (ft)	Concentration at Unnamed Stream (µg/L)
2015	Below GW Standard	Below GW Standard	Below GW Standard	Below SW Standard
2025	Below GW Standard	Below GW Standard	Below GW Standard	Below SW Standard

VC (Initial Source Concentration 10,000 µg/L)

Date	Maximum Concentration (µg/L)	Distance from Source of Maximum Concentration (ft)	Maximum Plume Extent (ft)	Concentration at Unnamed Stream (µg/L)
2015	1	400	2,850	Below SW Standard
2025	Below GW Standard	Below GW Standard	Below GW Standard	Below SW Standard

Notes:
TCE = Trichloroethene, cis-1,2-DCE = cis-1,2-dichloroethene, VC = vinyl chloride
"SW Standard" refers to the NC2B, "Class C," Surface Water Standard: TCE = 30 µg/L (NC2B), cis-1,2-DCE = 4,900 µg/L (ECOTOX & RAIS), and VC = 2.4 µg/L (NC2B)
"GW Standard" refers to the NC2L Groundwater Standard: TCE = 2.8 µg/L, cis-1,2-DCE = 70 µg/L, and VC = 0.015 µg/L

Table 6-12
Summary of BIOCHLOR Prediction
Lower Surficial Aquifer, Former Refueling Station Source Area
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

TCE (Initial Source Concentration 6,000 µg/L)

Date	Maximum Concentration (µg/L)	Distance from Source of Maximum Concentration (ft)	Maximum Plume Extent (ft)	Concentration at Unnamed Stream (µg/L)
2015	5.5	Source	170	Below SW Standard
2025	Below GW Standard	Below GW Standard	-	Below SW Standard

cis-1,2-DCE (Initial Source Concentration 50 µg/L)

Date	Maximum Concentration (µg/L)	Distance from Source of Maximum Concentration (ft)	Maximum Plume Extent (ft)	Concentration at Unnamed Stream (µg/L)
2015	Below GW Standard	Below GW Standard	Below GW Standard	Below SW Standard
2025	Below GW Standard	Below GW Standard	Below GW Standard	Below SW Standard

VC (Initial Source Concentration 1 µg/L)

Date	Maximum Concentration (µg/L)	Distance from Source of Maximum Concentration (ft)	Maximum Plume Extent (ft)	Concentration at Unnamed Stream (µg/L)
2015	1	70	350	Below SW Standard
2025	Below GW Standard	Below GW Standard	Below GW Standard	Below SW Standard

Notes:
TCE = Trichloroethene, cis-1,2-DCE = cis-1,2-dichloroethene, VC = vinyl chloride
"SW Standard" refers to the NC2B, "Class C," Surface Water Standard: TCE = 30 µg/L (NC2B), cis-1,2-DCE = 4,900 µg/L (ECOTOX & RAIS), and VC = 2.4 µg/L (NC2B)
"GW Standard" refers to the NC2L Groundwater Standard: TCE = 2.8 µg/L, cis-1,2-DCE = 70 µg/L, and VC = 0.015 µg/L

Table 6-13
Summary of NAS Results
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

Upper Surficial Aquifer, Building 4075 Source Area

Time of Stabilization (TOS) and Max Source Conc. Calculations										
Distance to POC [ft]	900									
			Source Reduction		Time of Stabilization [years]					
	RCC		Conc [µg/L]		Breakthrough Time			Time to Equilibrium		
Contaminant	[µg/L]	Well	Current	Target	Maximum	Average	Minimum	Maximum	Average	Minimum
Total Chl. Eth.		1	174							
TCE	30	1	150	No Reduction Required						
cis-DCE	4900	1	24	No Reduction Required						
Vinyl Chl.	2.4	1	BD	Insufficient Data						

Lower Surficial Aquifer, Building 130 Source

Time of Stabilization (TOS) and Max Source Conc. Calculations										
Distance to POC [ft]	3000									
			Source Reduction		Time of Stabilization [years]					
	RCC		Conc [µg/L]		Breakthrough Time			Time to Equilibrium		
Contaminant	[µg/L]	Well	Current	Target	Maximum	Average	Minimum	Maximum	Average	Minimum
Total Chl. Eth.		1	111							
TCE	30	1	19	No Reduction Required						
cis-DCE	4900	1	98	No Reduction Required						
Vinyl Chl.	2.4	1	2	Insufficient Data						

Lower Surficial Aquifer, Former Refueling Station Source Area

Time of Stabilization (TOS) and Max Source Conc. Calculations										
Distance to POC [ft]	800									
			Source Reduction		Time of Stabilization [years]					
	RCC		Conc [µg/L]		Breakthrough Time			Time to Equilibrium		
Contaminant	[µg/L]	Well	Current	Target	Maximum	Average	Minimum	Maximum	Average	Minimum
Total Chl. Eth.		1	15							
TCE	30	1	15	No Reduction Required						
cis-DCE	4900	1	BD	Insufficient Data						
Vinyl Chl.	2.4	1	BD	Insufficient Data						

Notes:

TCE = Trichloroethene; DCE = cis-1,2-Dichloroethene; VC = Vinyl Chloride

POC = Point of Compliance

RCC = Regulatory Compliance Concentration -- NC2B, "Class C," Surface Water Standard: TCE = 30 µg/L (NC2B), cis-1,2-DCE = 4,900 µg/L (ECOTOX & RAIS), and VC = 2.4 µg/L (NC2B)

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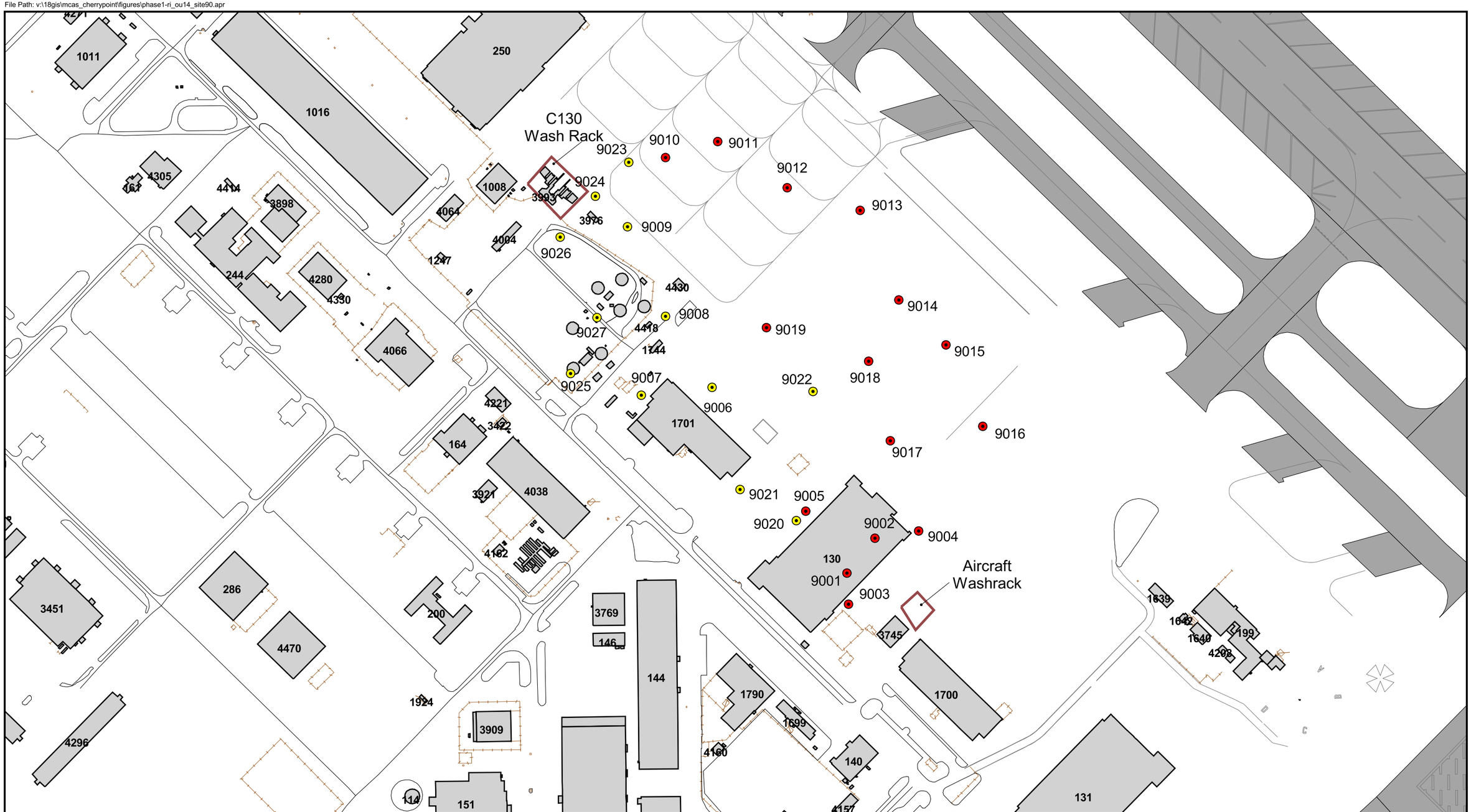

LEGEND

- Phase I Direct Push Technology Groundwater Sample Locations
- Phase I Direct Push Technology Groundwater and Soil Sample Locations
- Buildings

N

0 300 600 Feet

Figure 3-1
Phase I Remedial Investigation Sample Locations
(Direct Push Technology Soil and Groundwater)
Remedial Investigation for OU14, Site 90
MCAS Cherry Point, North Carolina

CH2MHILL

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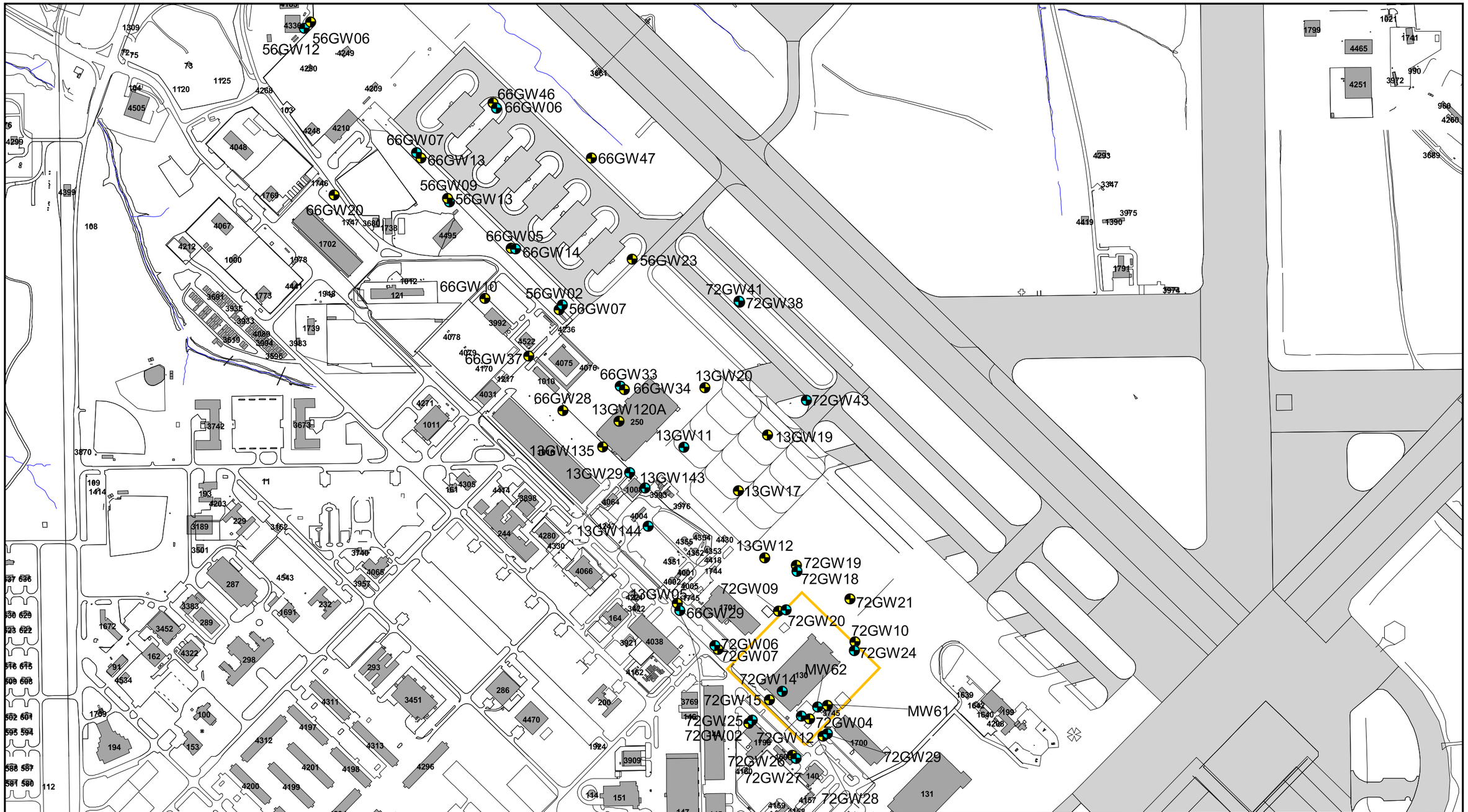

LEGEND

- Upper Surficial Aquifer Monitoring Well
- Lower Surficial Aquifer Monitoring Well
- Site 90 Boundary
- Buildings & Structures
- Airfield Pavement
- Water Bodies

N

0 600 1200 Feet

Figure 3-2
Phase II Remedieal Investigation Sample Locations
(Upper and Lower Surficial Aquifer Monitoring Well Groundwater)
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

CH2MHILL

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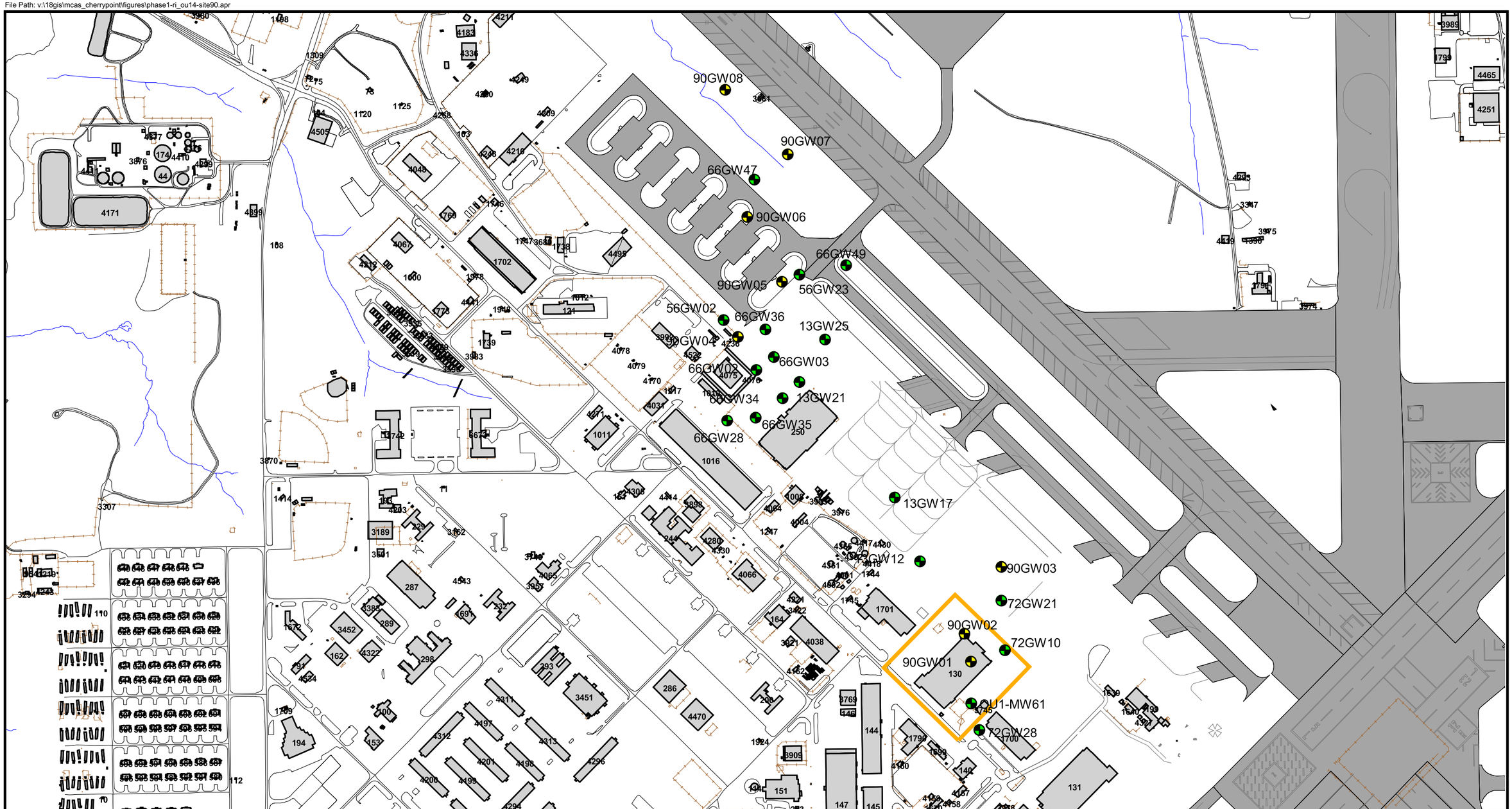

LEGEND

- Exisiting Upper Surficial Aquifer Monitoring Well
- New Upper Surficial Aquifer Monitoring Well (2005)
- Buildings
- Roads
- Water Bodies

N

0 650 1300 Feet

Figure 3-3
Phase III Remedial Investigation Sample Locations
(Upper Surficial Aquifer Monitoring Well Groundwater)
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

CH2MHILL

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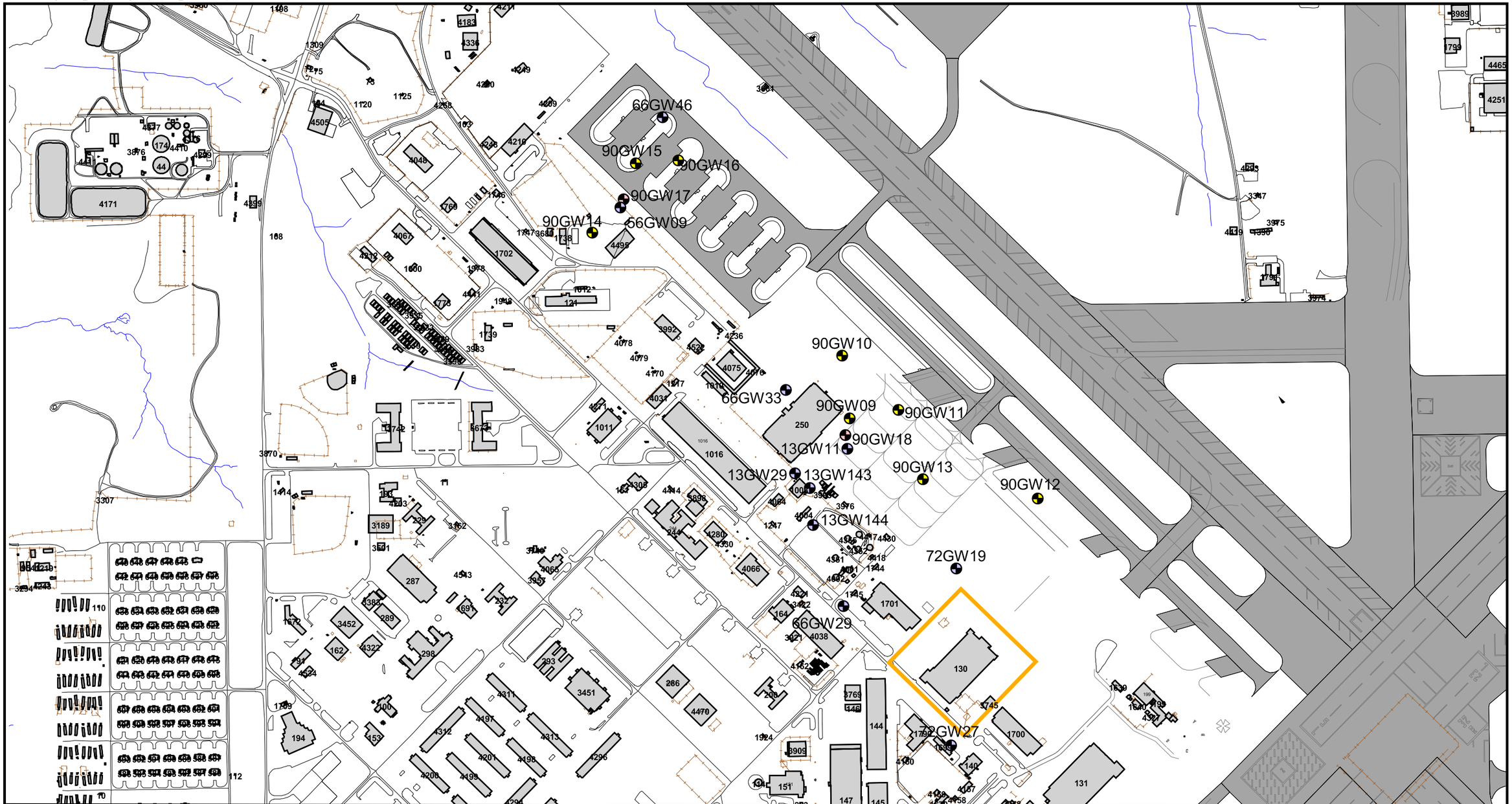

LEGEND

- Existing Lower Surficial Aquifer Monitoring Well
- New Lower Surficial Aquifer Monitoring Well (2005)
- New Yorktown Aquifer Monitoring Well (2005)
- Buildings
- Roads
- Water Bodies

N

0 650 1300 Feet

Figure 3-4
Phase III Remedial Investigation Sample Locations
(Lower Surficial and Yorktown Aquifers Monitoring Well Groundwater)
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

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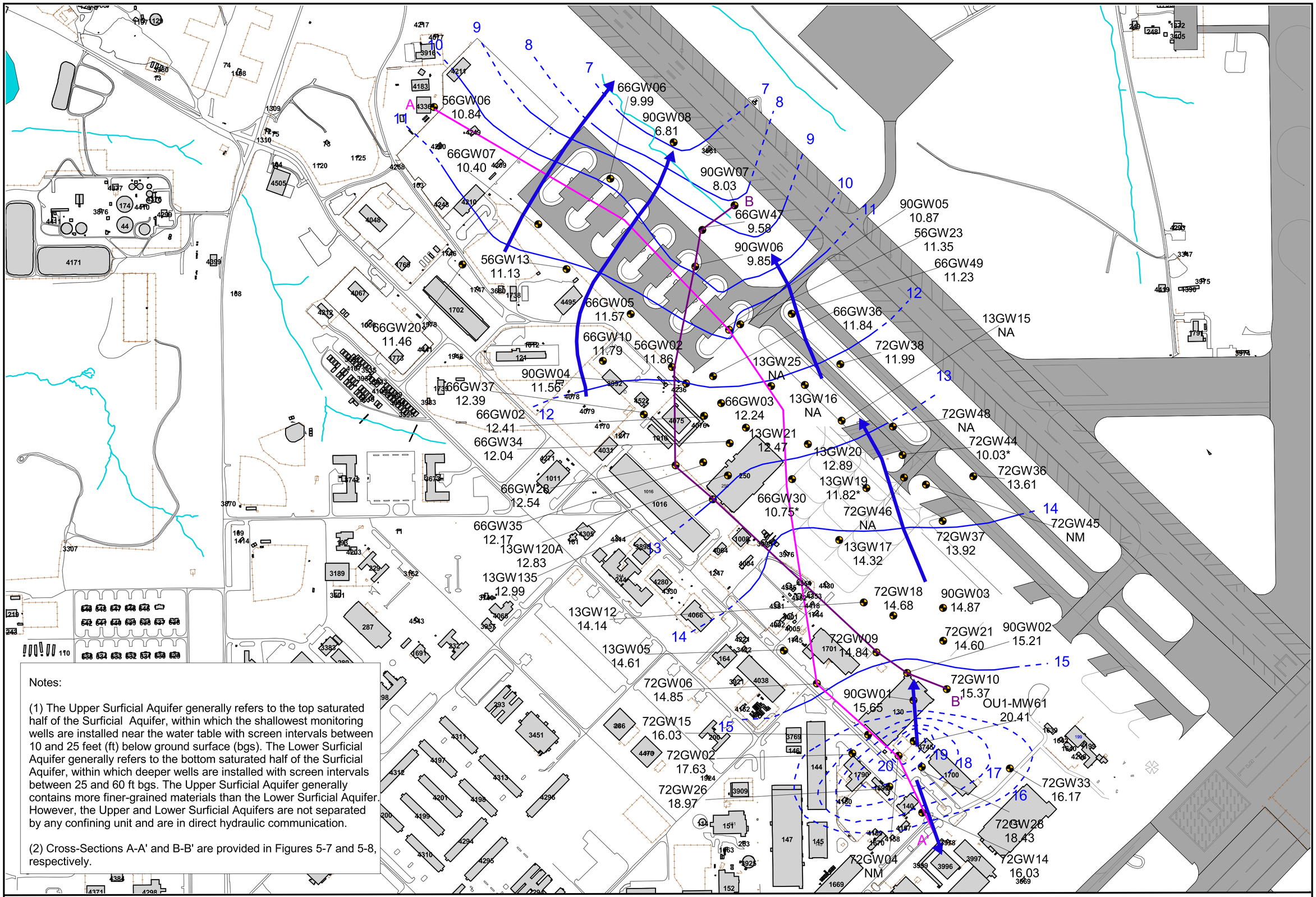

Notes:

(1) The Upper Surficial Aquifer generally refers to the top saturated half of the Surficial Aquifer, within which the shallowest monitoring wells are installed near the water table with screen intervals between 10 and 25 feet (ft) below ground surface (bgs). The Lower Surficial Aquifer generally refers to the bottom saturated half of the Surficial Aquifer, within which deeper wells are installed with screen intervals between 25 and 60 ft bgs. The Upper Surficial Aquifer generally contains more finer-grained materials than the Lower Surficial Aquifer. However, the Upper and Lower Surficial Aquifers are not separated by any confining unit and are in direct hydraulic communication.

(2) Cross-Sections A-A' and B-B' are provided in Figures 5-7 and 5-8, respectively.

LEGEND

- Upper Surficial Aquifer Monitoring Well Locations
- Buildings
- Groundwater Contours
- Groundwater Contours (Inferred)
- Streams
- Transect A-A'
- TransectB-B'
- 15.85 Groundwater Elevation in ft. amsl
- NM Not Measured
- NA Not Available
- * Anomalous groundwater data in wells 13GW19, 66GW30, and 72GW44. Groundwater data not used to generate Upper Surficial Aquifer groundwater elevation contours. It is not clear why the groundwater levels in these wells are lower than expected, but may be due to delayed equilibration.
- Groundwater Flow Direction

Figure 3-5
Upper Surficial Aquifer
Water Level Map (April 14, 2005)
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

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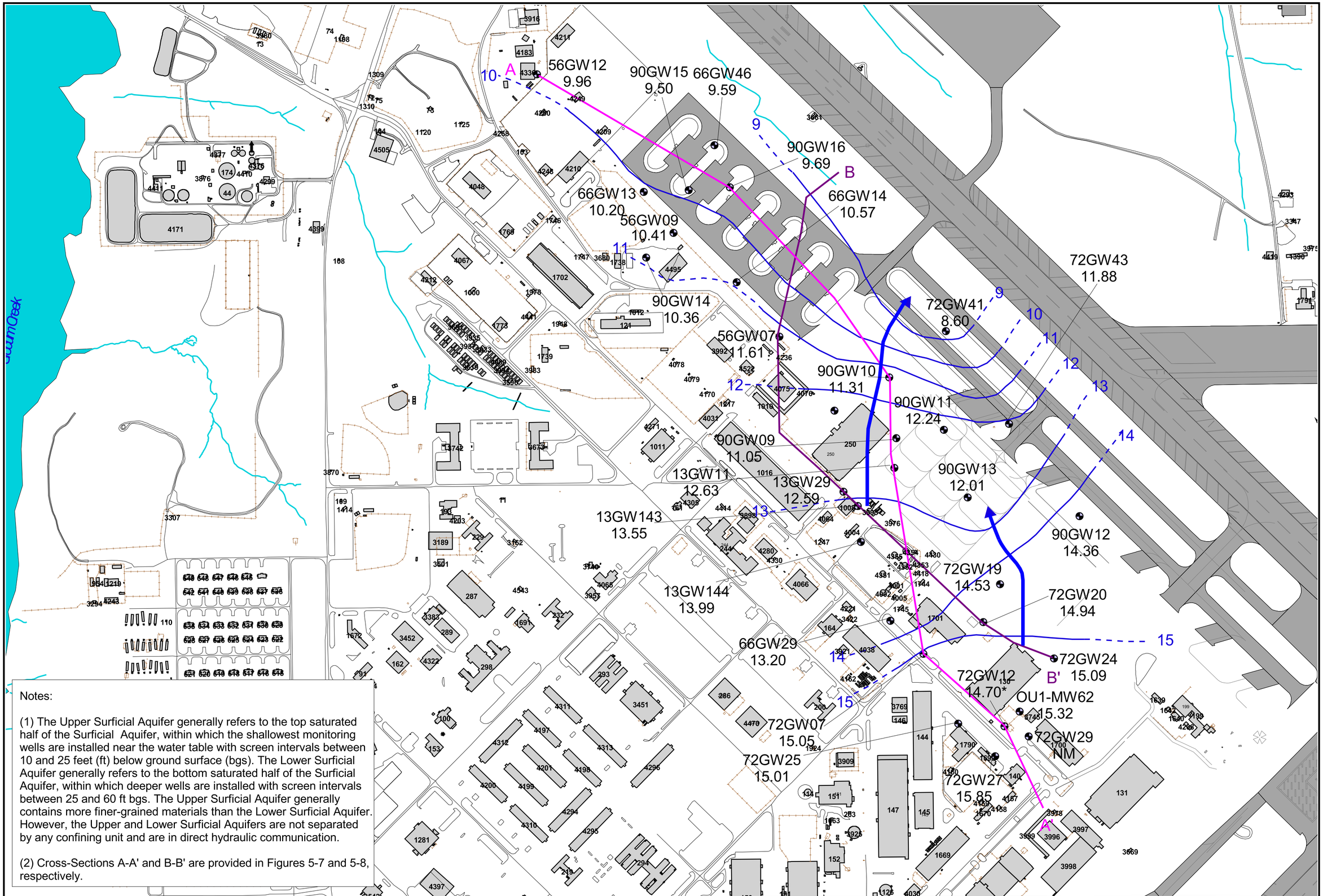
File Path: v:\18gis\mcas_cherrypoint\figures\phase1-ri_ou14-site90.apr



Notes:

(1) The Upper Surficial Aquifer generally refers to the top saturated half of the Surficial Aquifer, within which the shallowest monitoring wells are installed near the water table with screen intervals between 10 and 25 feet (ft) below ground surface (bgs). The Lower Surficial Aquifer generally refers to the bottom saturated half of the Surficial Aquifer, within which deeper wells are installed with screen intervals between 25 and 60 ft bgs. The Upper Surficial Aquifer generally contains more finer-grained materials than the Lower Surficial Aquifer. However, the Upper and Lower Surficial Aquifers are not separated by any confining unit and are in direct hydraulic communication.

(2) Cross-Sections A-A' and B-B' are provided in Figures 5-7 and 5-8, respectively.

LEGEND

- Lower Surficial Aquifer Monitoring Well Locations
- Buildings
- Groundwater Contours
- Groundwater Contours (Inferred)
- Streams
- Transect A-A'
- Transect B-B'
- 15.85 Groundwater Elevation in ft. amsl
- NM Not Measured
- Groundwater Flow Direction
- * Anomalous groundwater data in well 72GW12. Groundwater data not used to generate Lower Surficial Aquifer groundwater elevation contours. It is not clear why the groundwater level in this well is higher than expected, but may be due to delayed equililbration.

N

0 450 900 Feet

Figure 3-6
Lower Surficial Aquifer
Water Level Map (April 14, 2005)
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

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\\aphrodite\projects\USNavFacEngCom\CherryPoint\Projects\Figure 3-7 - Phase III Surface Water and Sediment Sample Locations.mxd

Legend

- Sediment Sample
- Surface Water
- Surface Water/Sediment Sample
- Water Bodies and Streams
- Intermittent Water Body
- Permanent Water Body

N
W E
S

0 250 500
Feet

Figure 3-7
Phase III Surface Water and Sediment Sample Locations
OU14, Site 90 Remedial Investigation
MCAS Cherry Point
North Carolina

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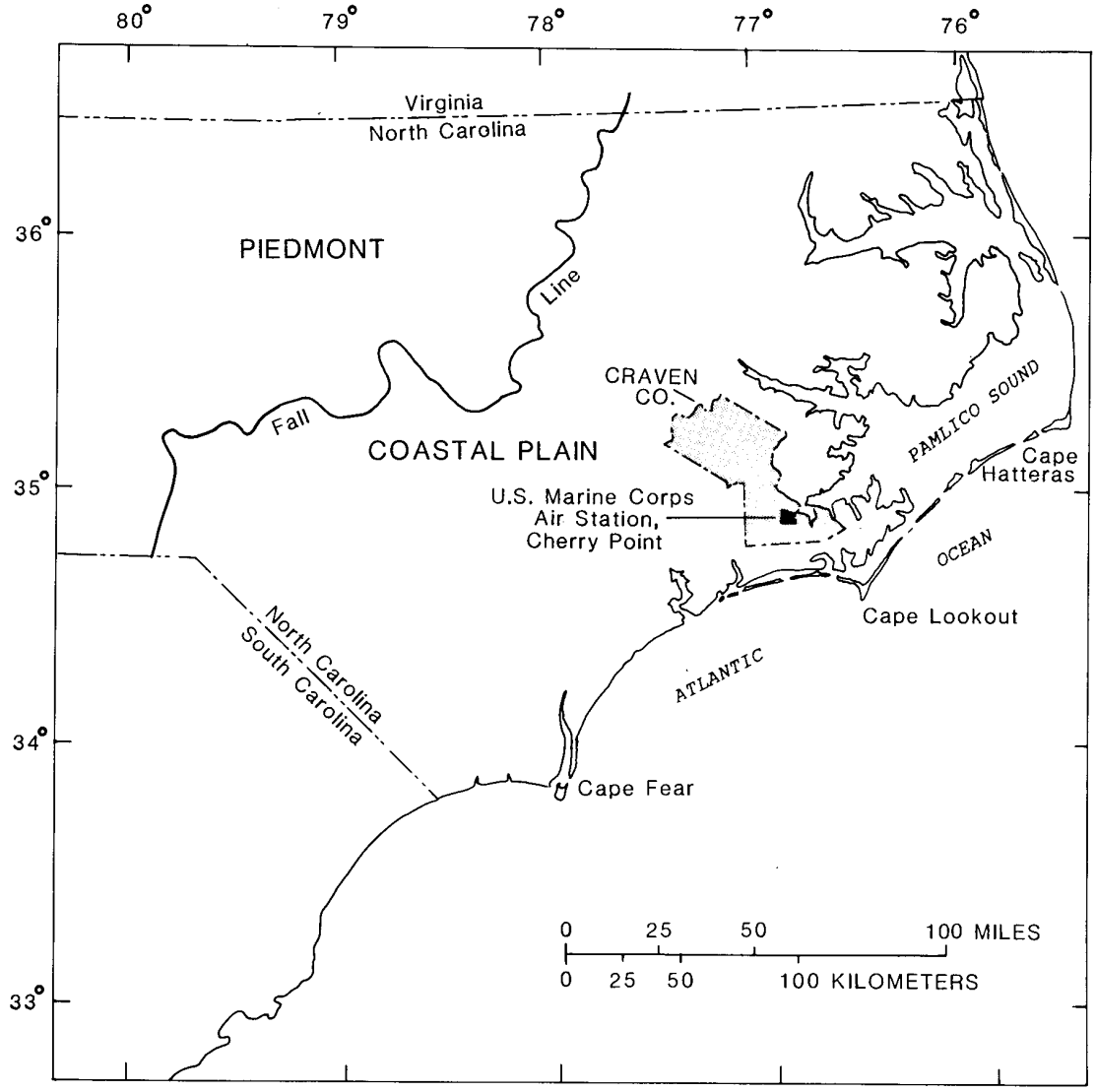
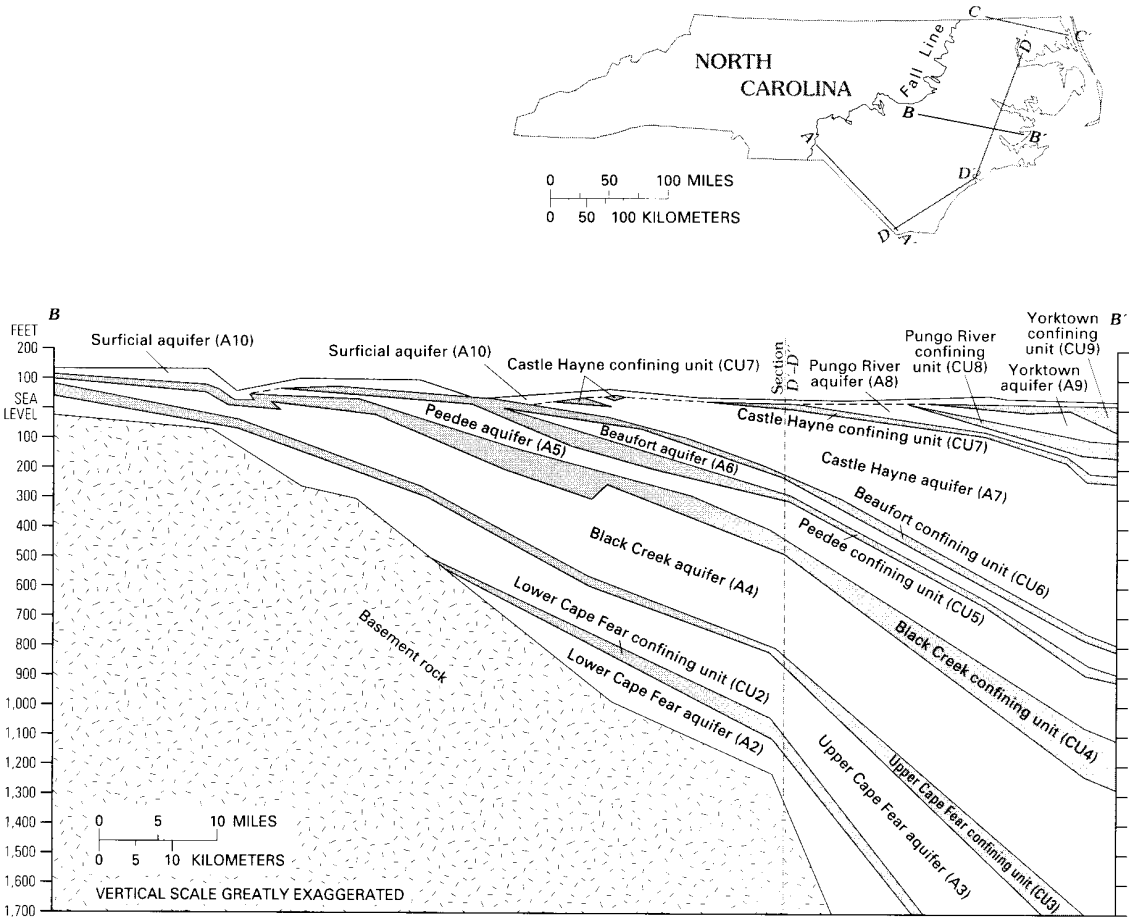
Cherry Point E11202020/4WDC<F4. 1. v2006>09/01/06.wdc



Source: Murray and Keoughan, 1990.

Figure 4-1
Location of MCAS Cherry Point
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

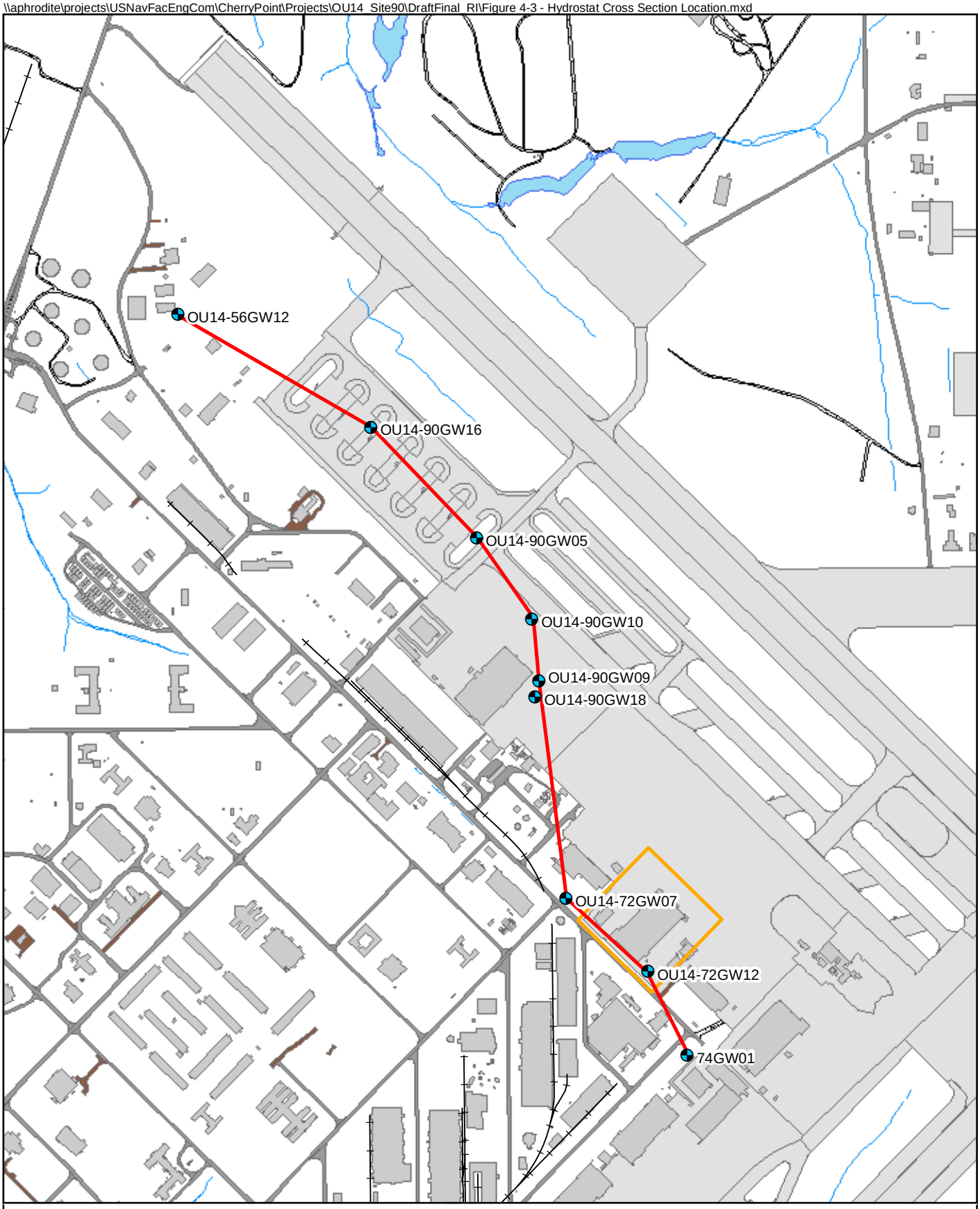
Cherry Point_E112002004WDC-F4_3_v2006-09/01/06.wdc



Source: Giese, Eimers, and Coble, 1997.

Figure 4-2
Regional Hydrogeologic Cross Section
OU14, Site 90 Remedial Investigation
MCAS Cherry Point, North Carolina

\\aphrodite\projects\USNavFacEngCom\CherryPoint\Projects\OU14_Site90\DraftFinal_RI\Figure 4-3 - Hydrostat Cross Section Location.mxd



Legend

- Monitoring Well
- Cross-Section Location
- Site Boundary
- Surface Water
- Paved Road
- Unpaved Road
- Existing Buildings
- Airfield Surface

N
W E
S

0 350 700
Feet

Figure 4-3
Hydrostratigraphic Cross Section Location
OU14, Site 90 Remedial Investigation
MCAS Cherry Point
North Carolina

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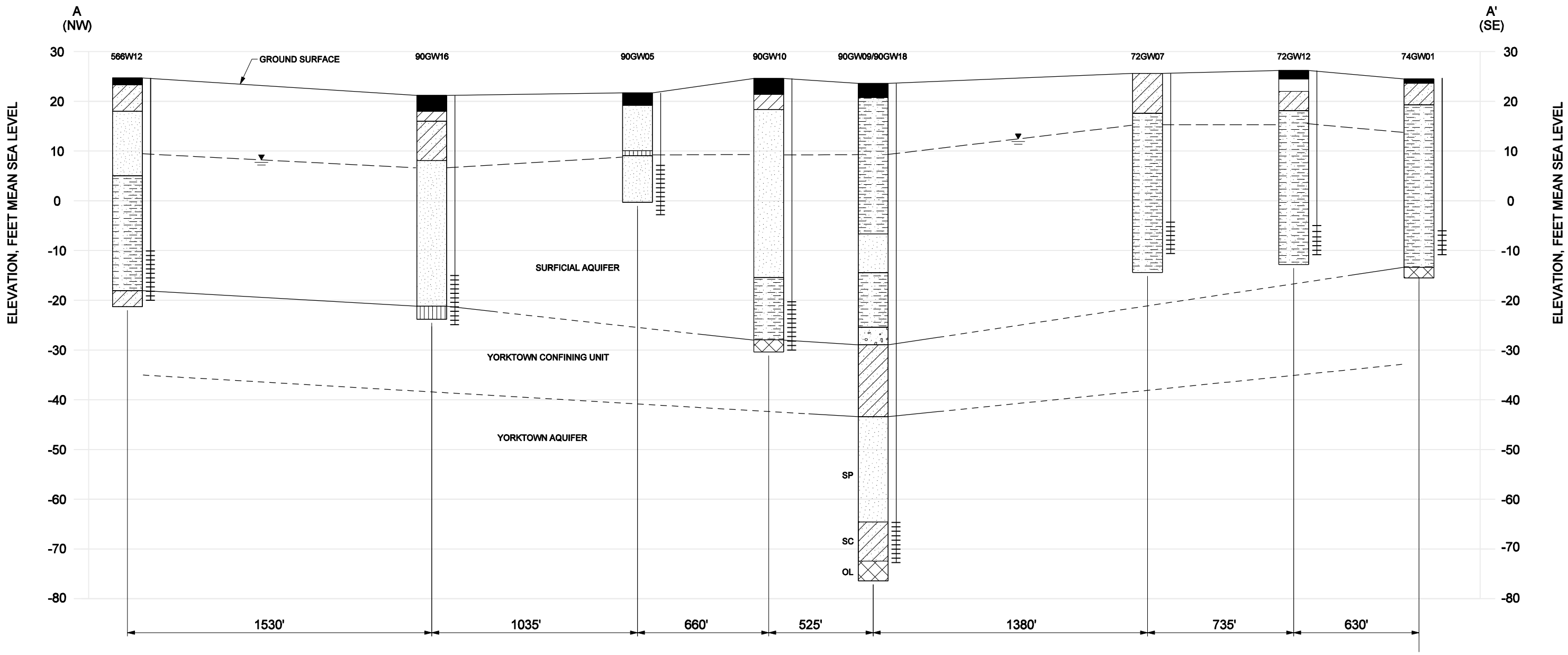

PROFILE

VERTICAL SCALE: 1"=20'
HORIZONTAL SCALE : 1"=500'

LITHOLOGY/USCS DESCRIPTION

- ASPHALT/CONCRETE/FILL
- SW: WELL GRADED SANDS
- SP: POORLY GRADED SANDS
- SM: SILTY SANDS
- SC: CLAYEY SANDS
- CL: INORGANIC CLAYS (LOW PLASTICITY)
- CH: INORGANIC CLAYS (HIGH PLASTICITY)
- OL: ORGANIC SILTS (LOW PLASTICITY)

LEGEND

- MONITORING WELL SCREENED INTERVAL
- GROUND WATER TABLE

STRATIGRAPHY

- HYDROSTRATIGRAPHIC CONTACT
- HYDROSTRATIGRAPHIC CONTACT (INFERRED)

NOTES:
1. THIS CROSS SECTION IS INTERPRETIVE AND WAS PREPARED BY INTERPOLATION BETWEEN BORING LOCATIONS. ACTUAL CONDITIONS BETWEEN BORINGS MAY DIFFER FROM THOSE SHOWN HERE.

FIGURE 4-4
HYDROSTRATIGRAPHIC CROSS-SECTION A-A'
OU14, SITE 90 REMEDIAL INVESTIGATION
MCAS CHERRY POINT, NORTH CAROLINA

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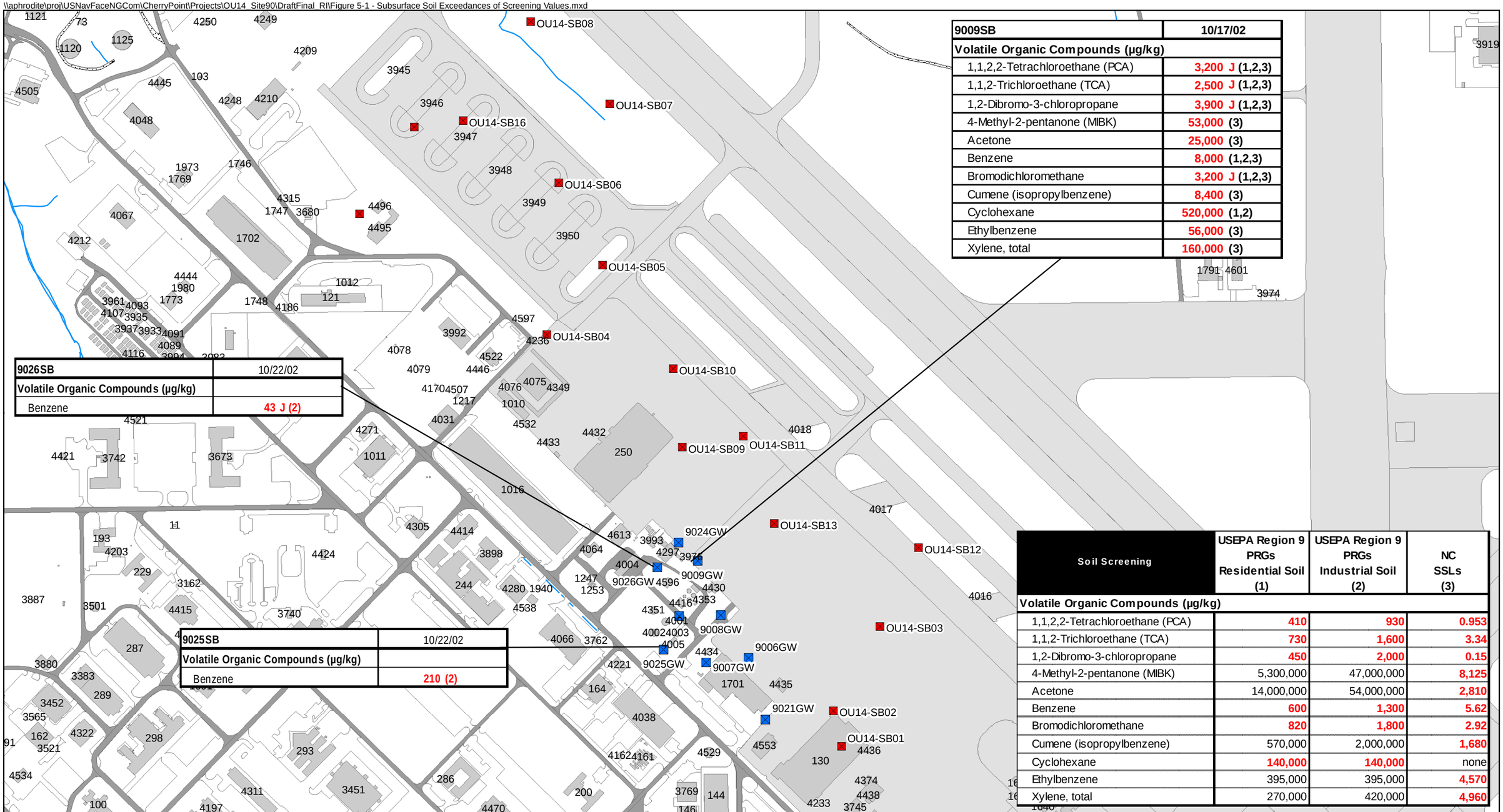
\\aphrodite\proj\USNavFaceNGCom\CherryPoint\Projects\OU14_Site90\DraftFinal_RI\Figure 5-1 - Subsurface Soil Exceedances of Screening Values.mxd



9009SB	10/17/02
Volatile Organic Compounds (µg/kg)	
1,1,2,2-Tetrachloroethane (PCA)	3,200 J (1,2,3)
1,1,2-Trichloroethane (TCA)	2,500 J (1,2,3)
1,2-Dibromo-3-chloropropane	3,900 J (1,2,3)
4-Methyl-2-pentanone (MIBK)	53,000 (3)
Acetone	25,000 (3)
Benzene	8,000 (1,2,3)
Bromodichloromethane	3,200 J (1,2,3)
Cumene (isopropylbenzene)	8,400 (3)
Cyclohexane	520,000 (1,2)
Ethylbenzene	56,000 (3)
Xylene, total	160,000 (3)

9026SB	10/22/02
Volatile Organic Compounds (µg/kg)	
Benzene	43 J (2)

9025SB	10/22/02
Volatile Organic Compounds (µg/kg)	
Benzene	210 (2)

Soil Screening	USEPA Region 9 PRGs Residential Soil (1)	USEPA Region 9 PRGs Industrial Soil (2)	NC SSLs (3)
Volatile Organic Compounds (µg/kg)			
1,1,2,2-Tetrachloroethane (PCA)	410	930	0.953
1,1,2-Trichloroethane (TCA)	730	1,600	3.34
1,2-Dibromo-3-chloropropane	450	2,000	0.15
4-Methyl-2-pentanone (MIBK)	5,300,000	47,000,000	8,125
Acetone	14,000,000	54,000,000	2,810
Benzene	600	1,300	5.62
Bromodichloromethane	820	1,800	2.92
Cumene (isopropylbenzene)	570,000	2,000,000	1,680
Cyclohexane	140,000	140,000	none
Ethylbenzene	395,000	395,000	4,570
Xylene, total	270,000	420,000	4,960

Legend

- Subsurface Soil Sample Location (2002/2008)
- Subsurface Soil Sample Location (2005)
- Surface Water

Each screening criteria has been assigned a reference number listed in the column header.
The reference number is used to identify specific criteria exceeded in a particular sample.
Only locations with exceedances have textboxes.
No sample was collected at OU14-SB07 during the installation of monitoring well 90GW07.

VOC - Volatile Organic Compound
µg/L - micrograms per liter
J - Estimated
PRG - Preliminary Remediation Goal
NC SSL - North Carolina Soil Screening Level

N W E S

0 250 500 Feet

Figure 5-1
Subsurface Soil Exceedances of Screening Values
OU14, Site 90 Remedial Investigation
MCAS Cherry Point
North Carolina

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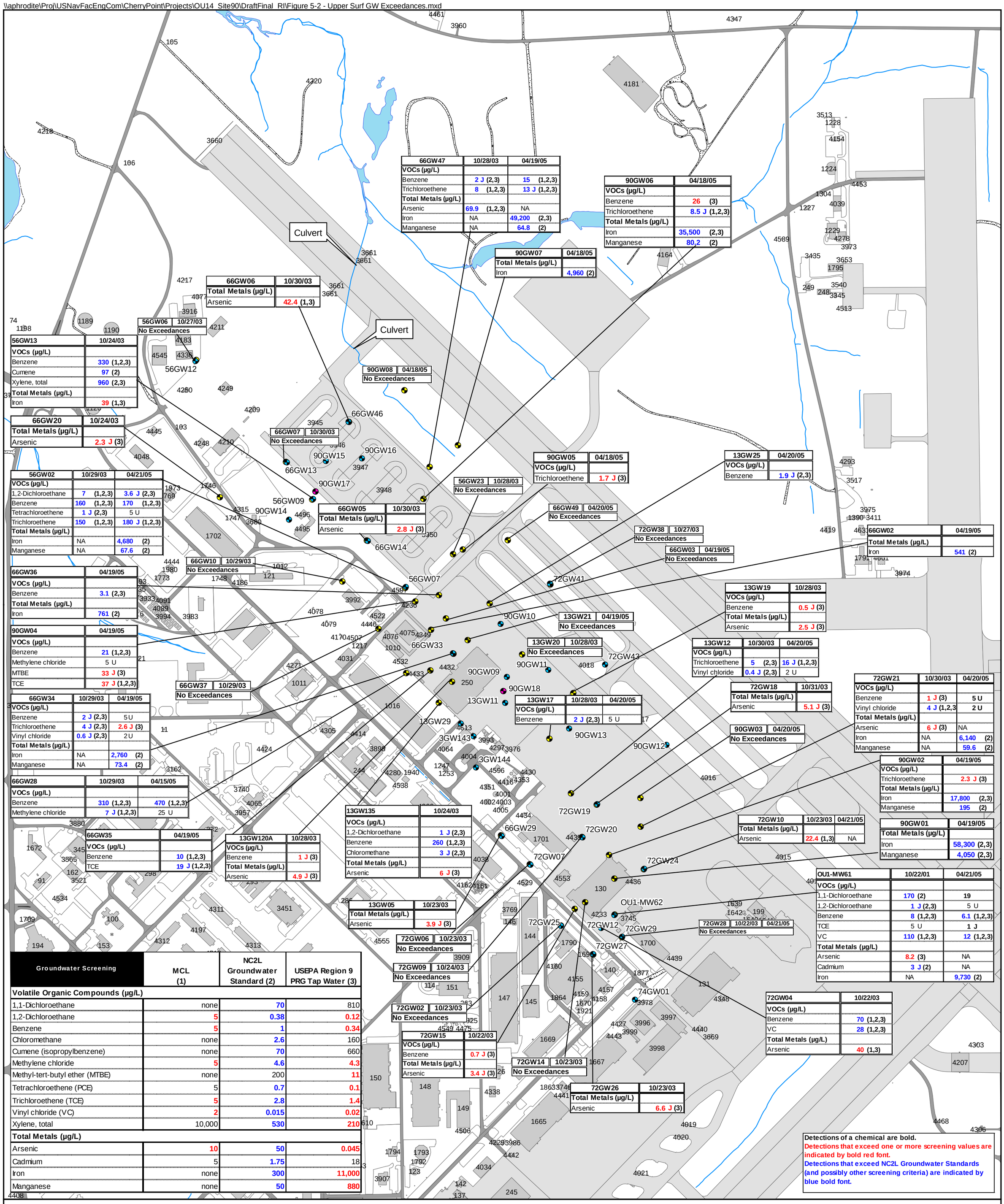
\\aphrodite\Proj\USNavFacEngCom\CherryPoint\Projects\OU14_Site90\DraftFinal_RI\Figure 5-2 - Upper Surf GW Exceedances.mxd



66GW47	10/28/03	04/19/05
VOCs (µg/L)		
Benzene	2 J (2,3)	15 (1,2,3)
Trichloroethene	8 (1,2,3)	13 J (1,2,3)
Total Metals (µg/L)		
Arsenic	69.9 (1,2,3)	NA
Iron	NA	49,200 (2,3)
Manganese	NA	64.8 (2)

90GW06	04/18/05
VOCs (µg/L)	
Benzene	26 (3)
Trichloroethene	8.5 J (1,2,3)
Total Metals (µg/L)	
Iron	35,500 (2,3)
Manganese	80.2 (2)

90GW07	04/18/05
Total Metals (µg/L)	
Iron	4,960 (2)

66GW06	10/30/03
Total Metals (µg/L)	
Arsenic	42.4 (1,3)

56GW06	10/27/03
No Exceedances	

56GW13	10/24/03
VOCs (µg/L)	
Benzene	330 (1,2,3)
Cumene	97 (2)
Xylene, total	960 (2,3)
Total Metals (µg/L)	
Iron	39 (1,3)

90GW08	04/18/05
No Exceedances	

66GW20	10/24/03
Total Metals (µg/L)	
Arsenic	2.3 J (3)

66GW07	10/30/03
No Exceedances	

56GW02	10/29/03	04/21/05
VOCs (µg/L)		
1,2-Dichloroethane	7 (1,2,3)	3.6 J (2,3)
Benzene	160 (1,2,3)	170 (1,2,3)
Tetrachloroethene	1 J (2,3)	5 U
Trichloroethene	150 (1,2,3)	180 J (1,2,3)
Total Metals (µg/L)		
Iron	NA	4,680 (2)
Manganese	NA	67.6 (2)

56GW23	10/28/03
No Exceedances	

90GW05	04/18/05
VOCs (µg/L)	
Trichloroethene	1.7 J (3)

13GW25	04/20/05
VOCs (µg/L)	
Benzene	1.9 J (2,3)

66GW05	10/30/03
Total Metals (µg/L)	
Arsenic	2.8 J (3)

66GW49	04/20/05
No Exceedances	

72GW38	10/27/03
No Exceedances	

66GW02	04/19/05
Total Metals (µg/L)	
Iron	541 (2)

66GW03	04/19/05
No Exceedances	

66GW10	10/29/03
No Exceedances	

66GW36	04/19/05
VOCs (µg/L)	
Benzene	3.1 (2,3)
Total Metals (µg/L)	
Iron	761 (2)

13GW19	10/28/03
VOCs (µg/L)	
Benzene	0.5 J (3)
Total Metals (µg/L)	
Arsenic	2.5 J (3)

90GW04	04/19/05
VOCs (µg/L)	
Benzene	21 (1,2,3)
Methylene chloride	5 U
MTBE	33 J (3)
TCE	37 J (1,2,3)

13GW21	04/19/05
No Exceedances	

13GW20	10/28/03
No Exceedances	

13GW12	10/30/03	04/20/05
VOCs (µg/L)		
Trichloroethene	5 (2,3)	16 J (1,2,3)
Vinyl chloride	0.4 J (2,3)	2 U

66GW37	10/29/03
No Exceedances	

72GW18	10/31/03
Total Metals (µg/L)	
Arsenic	5.1 J (3)

72GW21	10/30/03	04/20/05
VOCs (µg/L)		
Benzene	1 J (3)	5 U
Vinyl chloride	4 J (1,2,3	2 U
Total Metals (µg/L)		
Arsenic	6 J (3)	NA
Iron	NA	6,140 (2)
Manganese	NA	59.6 (2)

66GW34	10/29/03	04/19/05
VOCs (µg/L)		
Benzene	2 J (2,3)	5 U
Trichloroethene	4 J (2,3)	2.6 J (3)
Vinyl chloride	0.6 J (2,3)	2 U
Total Metals (µg/L)		
Iron	NA	2,760 (2)
Manganese	NA	73.4 (2)

13GW17	10/28/03	04/20/05
VOCs (µg/L)		
Benzene	2 J (2,3)	5 U

90GW03	04/20/05
No Exceedances	

90GW02	04/19/05
VOCs (µg/L)	
Trichloroethene	2.3 J (3)
Total Metals (µg/L)	
Iron	17,800 (2,3)
Manganese	195 (2)

66GW28	10/29/03	04/15/05
VOCs (µg/L)		
Benzene	310 (1,2,3)	470 (1,2,3)
Methylene chloride	7 J (1,2,3)	25 U

13GW135	10/24/03
VOCs (µg/L)	
1,2-Dichloroethane	1 J (2,3)
Benzene	260 (1,2,3)
Chloromethane	3 J (2,3)
Total Metals (µg/L)	
Arsenic	6 J (3)

72GW10	10/23/03	04/21/05
Total Metals (µg/L)		
Arsenic	22.4 (1,3)	NA

90GW01	04/19/05
Total Metals (µg/L)	
Iron	58,300 (2,3)
Manganese	4,050 (2,3)

66GW35	04/19/05
VOCs (µg/L)	
Benzene	10 (1,2,3)
TCE	19 J (1,2,3)

13GW120A	10/28/03
VOCs (µg/L)	
Benzene	1 J (3)
Total Metals (µg/L)	
Arsenic	4.9 J (3)

OU1-MW61	10/22/01	04/21/05
VOCs (µg/L)		
1,1-Dichloroethane	170 (2)	19
1,2-Dichloroethane	1 J (2,3)	5 U
Benzene	8 (1,2,3)	6.1 (1,2,3)
TCE	5 U	1 J
VC	110 (1,2,3)	12 (1,2,3)
Total Metals (µg/L)		
Arsenic	8.2 (3)	NA
Cadmium	3 J (2)	NA
Iron	NA	9,730 (2)

13GW05	10/23/03
Total Metals (µg/L)	
Arsenic	3.9 J (3)

72GW28	10/22/03	04/21/05
No Exceedances		

72GW06	10/23/03
No Exceedances	

72GW09	10/24/03
No Exceedances	

72GW04	10/22/03
VOCs (µg/L)	
Benzene	70 (1,2,3)
VC	28 (1,2,3)
Total Metals (µg/L)	
Arsenic	40 (1,3)

72GW02	10/23/03
No Exceedances	

72GW15	10/22/03
VOCs (µg/L)	
Benzene	0.7 J (3)
Total Metals (µg/L)	
Arsenic	3.4 J (3)

72GW14	10/23/03
No Exceedances	

72GW26	10/23/03
Total Metals (µg/L)	
Arsenic	6.6 J (3)

Groundwater Screening	MCL (1)	NC2L Groundwater Standard (2)	USEPA Region 9 PRG Tap Water (3)
Volatile Organic Compounds (µg/L)			
1,1-Dichloroethane	none	70	810
1,2-Dichloroethane	5	0.38	0.12
Benzene	5	1	0.34
Chloromethane	none	2.6	160
Cumene (isopropylbenzene)	none	70	660
Methylene chloride	5	4.6	4.3
Methyl-tert-butyl ether (MTBE)	none	200	11
Tetrachloroethene (PCE)	5	0.7	0.1
Trichloroethene (TCE)	5	2.8	1.4
Vinyl chloride (VC)	2	0.015	0.02
Xylene, total	10,000	530	210
Total Metals (µg/L)			
Arsenic	10	50	0.045
Cadmium	5	1.75	18
Iron	none	300	11,000
Manganese	none	50	880

Detections of a chemical are bold.
Detections that exceed one or more screening values are indicated by bold red font.
Detections that exceed NC2L Groundwater Standards (and possibly other screening criteria) are indicated by blue bold font.

Legend

- Upper Surficial Aquifer Monitoring Well
- Lower Surficial Aquifer Monitoring Well
- Yorktown Aquifer Monitoring Well
- Existing Buildings
- Permanent Water Body
- Surface Water

Each screening criteria has been assigned a reference number listed in parenthesis in the column header. The reference number is used to identify specific criteria exceeded in a particular sample.

NA - Not analyzed
U - Analyte not detected
J - Reported value is estimated
VOCs - Volatile Organic Compounds
MCL - Maximum Contaminant Level
PRGs - Preliminary Remediation Goals
NC2L GW - North Carolina Groundwater Quality Standards
µg/L - micrograms per liter

N W E S

0 250 500 Feet

Figure 5-2
Upper Surficial Aquifer Exceedances of Screening Values
OU14, Site 90 Remedial Investigation
MCAS Cherry Point
North Carolina

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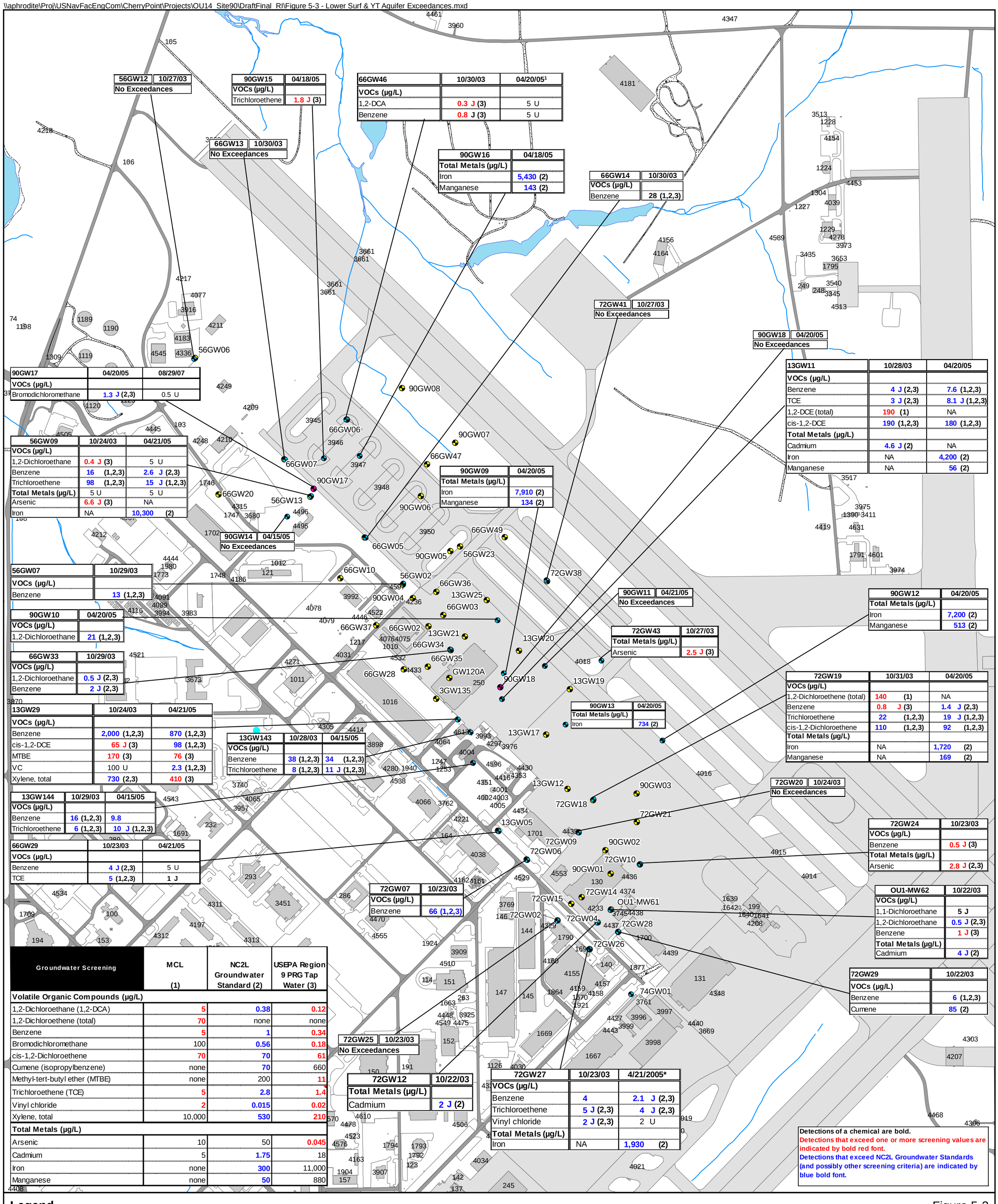
\\aphrodite\Proj\USNavFacEngCom\CherryPoint\Projects\OU14_Site90\DraftFinal_RI\Figure 5-3 - Lower Surf & YT Aquifer Exceedances.mxd



Groundwater Screening	MCL (1)	NC2L Groundwater Standard (2)	USEPA Region 9 PRG Tap Water (3)
Volatile Organic Compounds (µg/L)			
1,2-Dichloroethane (1,2-DCA)	5	0.38	0.12
1,2-Dichloroethene (total)	70	none	none
Benzene	5	1	0.34
Bromodichloromethane	100	0.56	0.18
cis-1,2-Dichloroethene	70	70	61
Cumene (isopropylbenzene)	none	70	660
Methyl-tert-butyl ether (MTBE)	none	200	11
Trichloroethene (TCE)	5	2.8	1.4
Vinyl chloride	2	0.015	0.02
Xylene, total	10,000	530	210
Total Metals (µg/L)			
Arsenic	10	50	0.045
Cadmium	5	1.75	18
Iron	none	300	11,000
Manganese	none	50	880

Legend

- Upper Surficial Aquifer Monitoring Well
- Lower Surficial Aquifer Monitoring Well; 74GW01
- Yorktown Aquifer Monitoring Well
- Existing Buildings
- Permanent Water Body
- Surface Water

Each screening criteria has been assigned a reference number listed in parenthesis in the column header. The reference number is used to identify specific criteria exceeded in a particular sample.

NA - Not analyzed
U - Analyte not detected
J - Reported value is estimated
VOCs - Volatile Organic Compounds
MCL - Maximum Contaminant Level
PRGs - Preliminary Remediation Goals
NC2L GW - North Carolina Groundwater Quality Standards
µg/L - micrograms per liter

N W E S

0 250 500 Feet

Figure 5-3
Lower Surficial Aquifer and Yorktown Aquifer
Exceedances of Screening Values
OU14, Site 90 Remedial Investigation
MCAS Cherry Point
North Carolina

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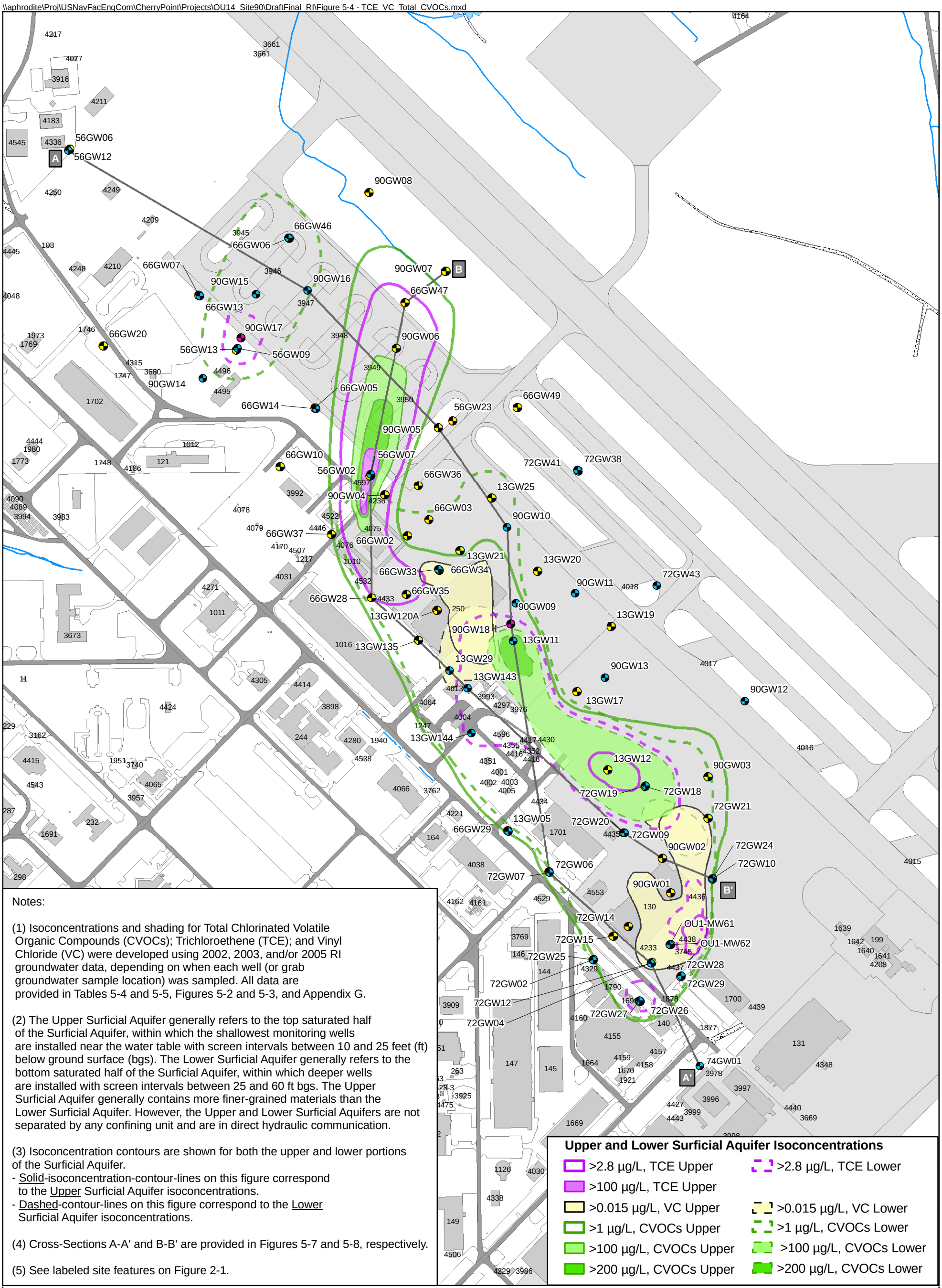
\\aphrodite\Proj\USNavFacEngCom\CherryPoint\Projects\OU14_Site90\DraftFinal_RI\Figure 5-4 - TCE_VC_Total_CVOCs.mxd



Notes:

(1) Isoconcentrations and shading for Total Chlorinated Volatile Organic Compounds (CVOCs); Trichloroethene (TCE); and Vinyl Chloride (VC) were developed using 2002, 2003, and/or 2005 RI groundwater data, depending on when each well (or grab groundwater sample location) was sampled. All data are provided in Tables 5-4 and 5-5, Figures 5-2 and 5-3, and Appendix G.

(2) The Upper Surficial Aquifer generally refers to the top saturated half of the Surficial Aquifer, within which the shallowest monitoring wells are installed near the water table with screen intervals between 10 and 25 feet (ft) below ground surface (bgs). The Lower Surficial Aquifer generally refers to the bottom saturated half of the Surficial Aquifer, within which deeper wells are installed with screen intervals between 25 and 60 ft bgs. The Upper Surficial Aquifer generally contains more finer-grained materials than the Lower Surficial Aquifer. However, the Upper and Lower Surficial Aquifers are not separated by any confining unit and are in direct hydraulic communication.

(3) Isoconcentration contours are shown for both the upper and lower portions of the Surficial Aquifer.
- Solid-isoconcentration-contour-lines on this figure correspond to the Upper Surficial Aquifer isoconcentrations.
- Dashed-contour-lines on this figure correspond to the Lower Surficial Aquifer isoconcentrations.

(4) Cross-Sections A-A' and B-B' are provided in Figures 5-7 and 5-8, respectively.

(5) See labeled site features on Figure 2-1.

Upper and Lower Surficial Aquifer Isoconcentrations

>2.8 µg/L, TCE Upper	>2.8 µg/L, TCE Lower
>100 µg/L, TCE Upper	
>0.015 µg/L, VC Upper	>0.015 µg/L, VC Lower
>1 µg/L, CVOCs Upper	>1 µg/L, CVOCs Lower
>100 µg/L, CVOCs Upper	>100 µg/L, CVOCs Lower
>200 µg/L, CVOCs Upper	>200 µg/L, CVOCs Lower

Legend
- Lower Surficial Aquifer Monitoring Well
- Yorktown Aquifer Monitoring Well
- Upper Surficial Aquifer Monitoring Well
- Transect for Cross-Section
- Surface Water

N W E S

0 250 500 Feet

Figure 5-4
Trichloroethene, Vinyl Chloride, and Total CVOCs
Upper and Lower Surficial Aquifer (Combined)
OU14, Site 90 Remedial Investigation
MCAS Cherry Point
North Carolina

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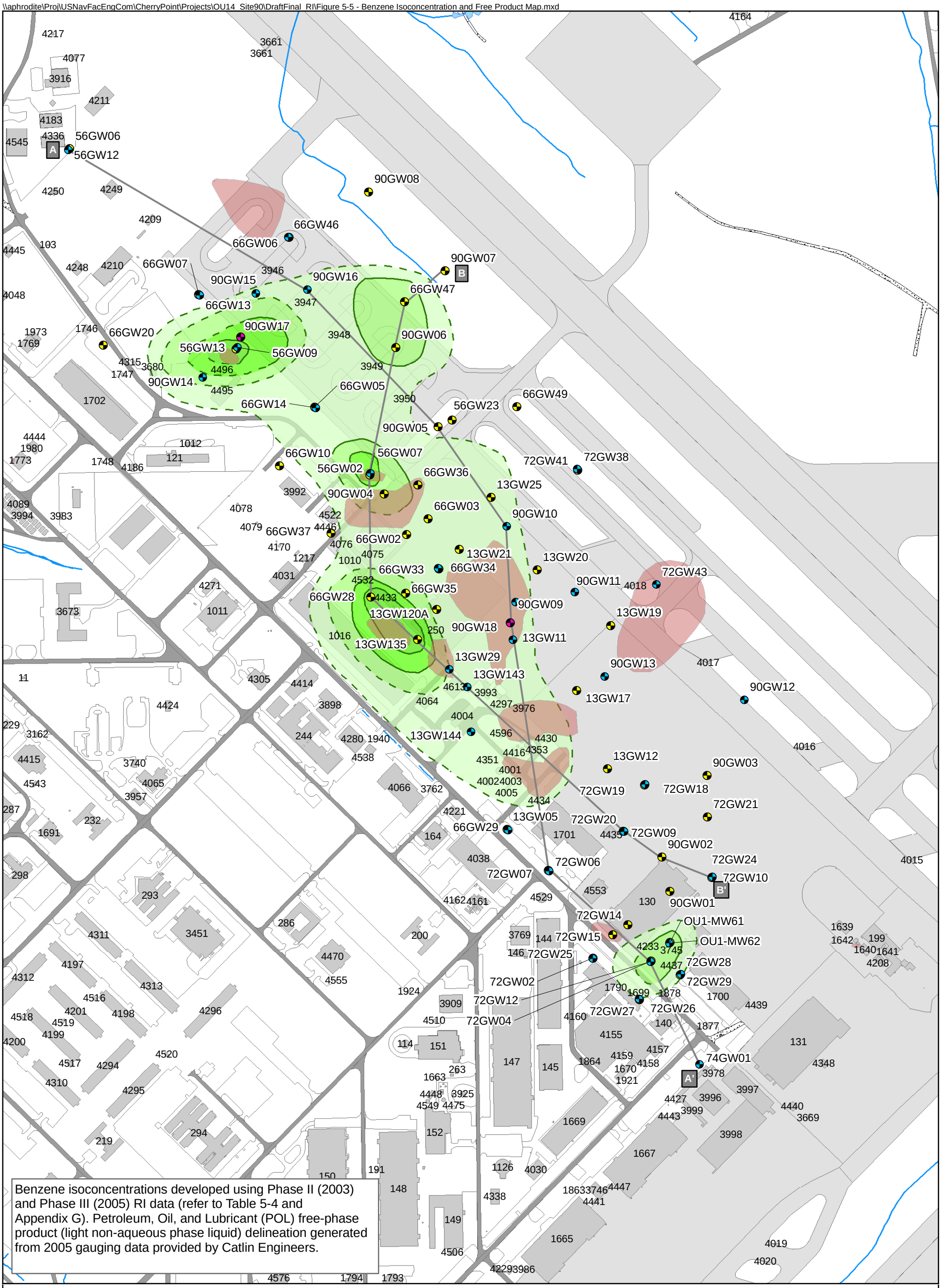
\\aphrodite\Proj\USNavFacEngCom\CherryPoint\Projects\OU14_Site90\DraftFinal_RI\Figure 5-5 - Benzene Isoconcentration and Free Product Map.mxd



Benzene isoconcentrations developed using Phase II (2003) and Phase III (2005) RI data (refer to Table 5-4 and Appendix G). Petroleum, Oil, and Lubricant (POL) free-phase product (light non-aqueous phase liquid) delineation generated from 2005 gauging data provided by Catlin Engineers.

Legend

- Upper Surficial Aquifer Monitoring Well
- Lower Surficial Aquifer Monitoring Well
- Yorktown Aquifer Monitoring Well
- Transect
- Surface Water
- Isoconcetration Contour (Inferred)
- Isoconcetration Contour
- Free Product

Benzene Isoconcentration Shading

- 1-5 µg/L
- 5-100 µg/L
- 100-200 µg/L
- > 200 µg/L

N W E S

0 250 500 Feet

Figure 5-5
Benzene and POL Free Product in the Upper Surficial Aquifer
OU14, Site 90 Remedial Investigation
MCAS Cherry Point
North Carolina

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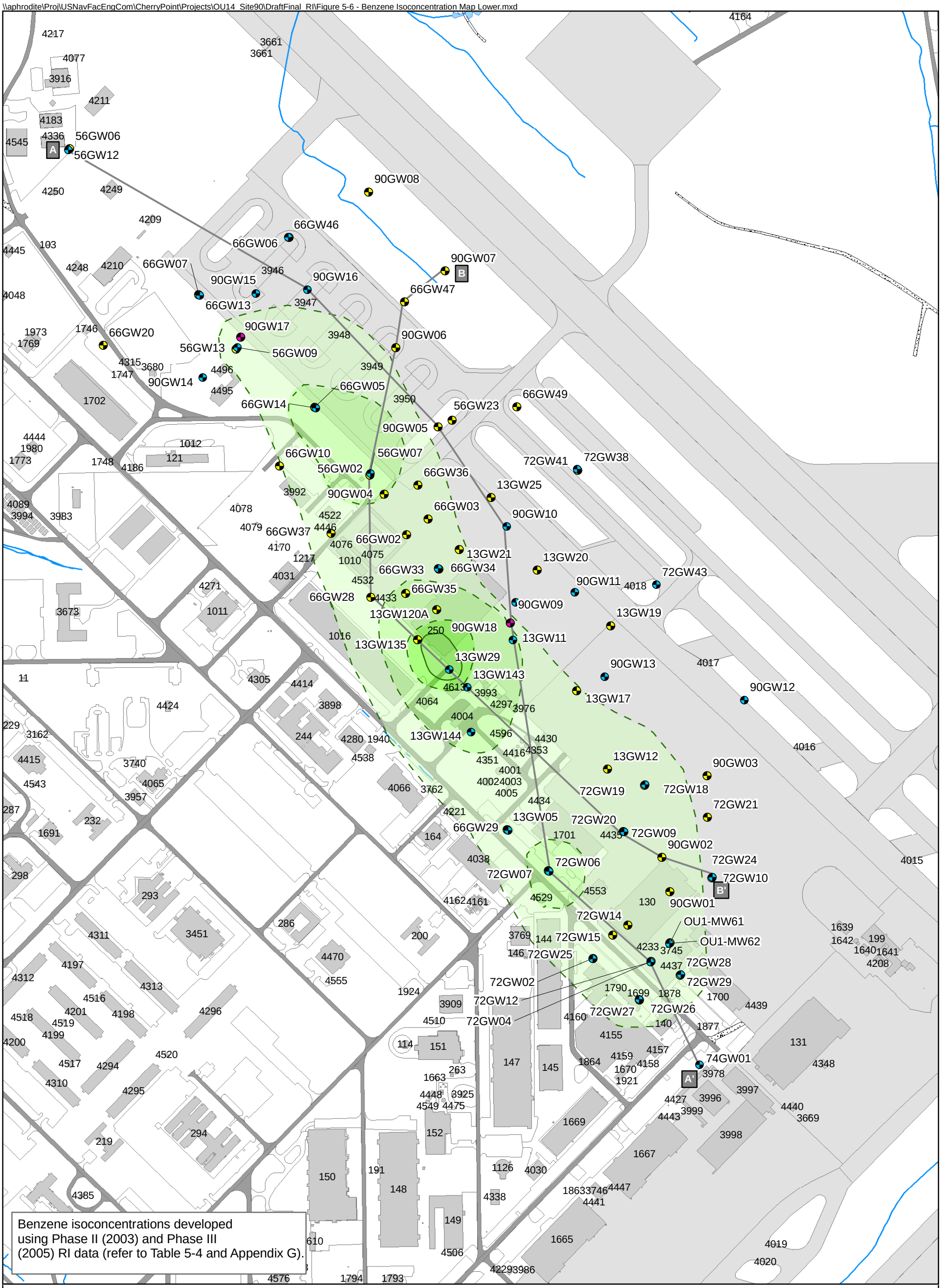
\\aphrodite\Proj\USNavFacEngCom\CherryPoint\Projects\OU14_Site90\DraftFinal_RI\Figure 5-6 - Benzene Isoconcentration Map Lower.mxd



Legend

- Upper Surficial Aquifer Monitoring Well
- Lower Surficial Aquifer Monitoring Well
- Yorktown Aquifer Monitoring Well
- Transect
- Surface Water
- Isoconcetration Contour (Inferred)
- Isoconcetration Contour

Benzene Isoconcentration Shading

- 1-5 µg/L
- 5-100 µg/L
- 100-200 µg/L
- > 200 µg/L

N W E S

0 250 500 Feet

Figure 5-6
Benzene in the
Lower Surficial Aquifer
OU14, Site 90 Remedial Investigation
MCAS Cherry Point
North Carolina

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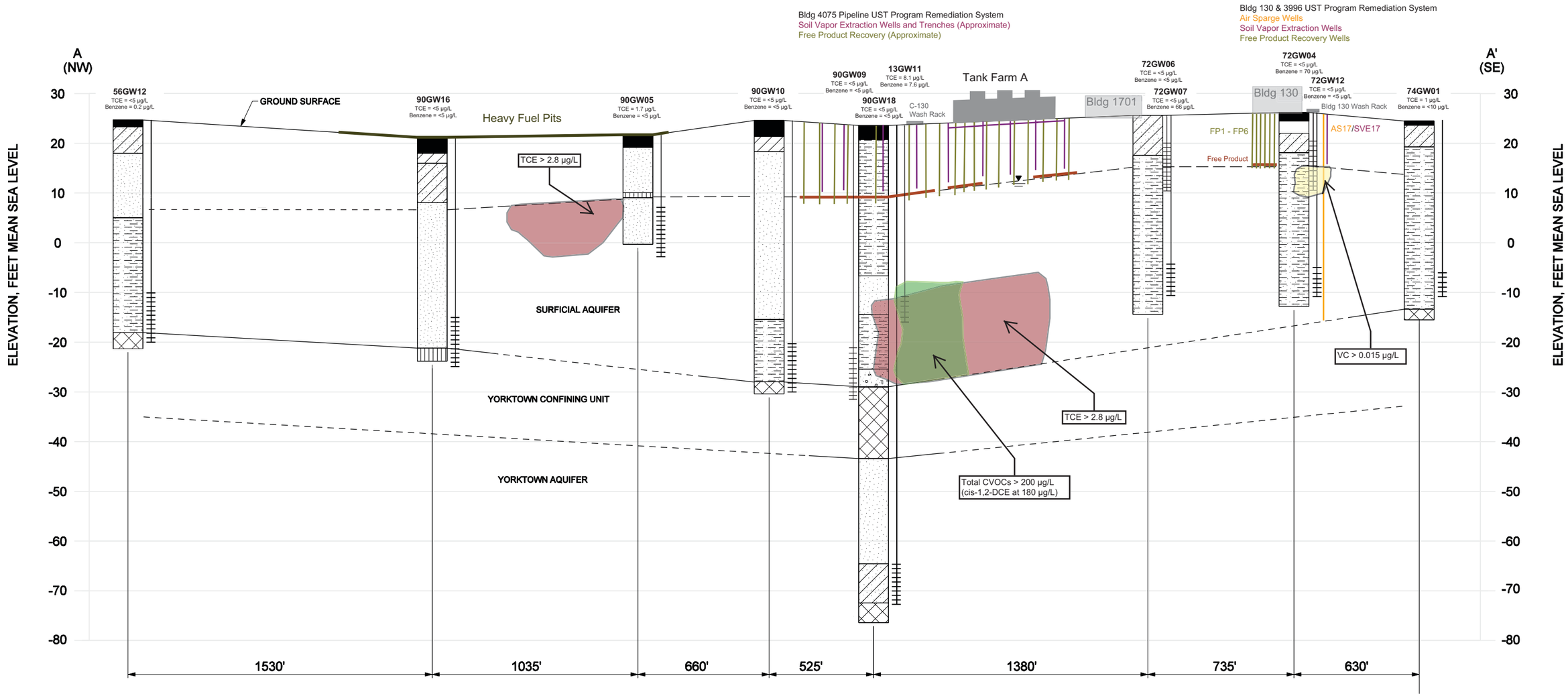


PROFILE

VERTICAL SCALE: 1"=20'
HORIZONTAL SCALE : 1"=500'

Notes:
(1) This cross-section is interpretive and was prepared by interpolation between boring locations. Actual conditions between borings may differ from those shown here.
(2) Isocontours are interpretive and intended to provide an approximate visual snapshot of conditions in the Surficial Aquifer.
(3) UST Remediation System component locations are approximate.
(4) Structure locations and sizes are approximate.

LITHOLOGY/USCS DESCRIPTION

- ASPHALT/CONCRETE/FILL
- SW: WELL GRADED SANDS
- SP: POORLY GRADED SANDS
- SM: SILTY SANDS
- SC: CLAYEY SANDS
- CL: INORGANIC CLAYS (LOW PLASTICITY)
- CH: INORGANIC CLAYS (HIGH PLASTICITY)
- OL: ORGANIC SILTS (LOW PLASTICITY)

LEGEND

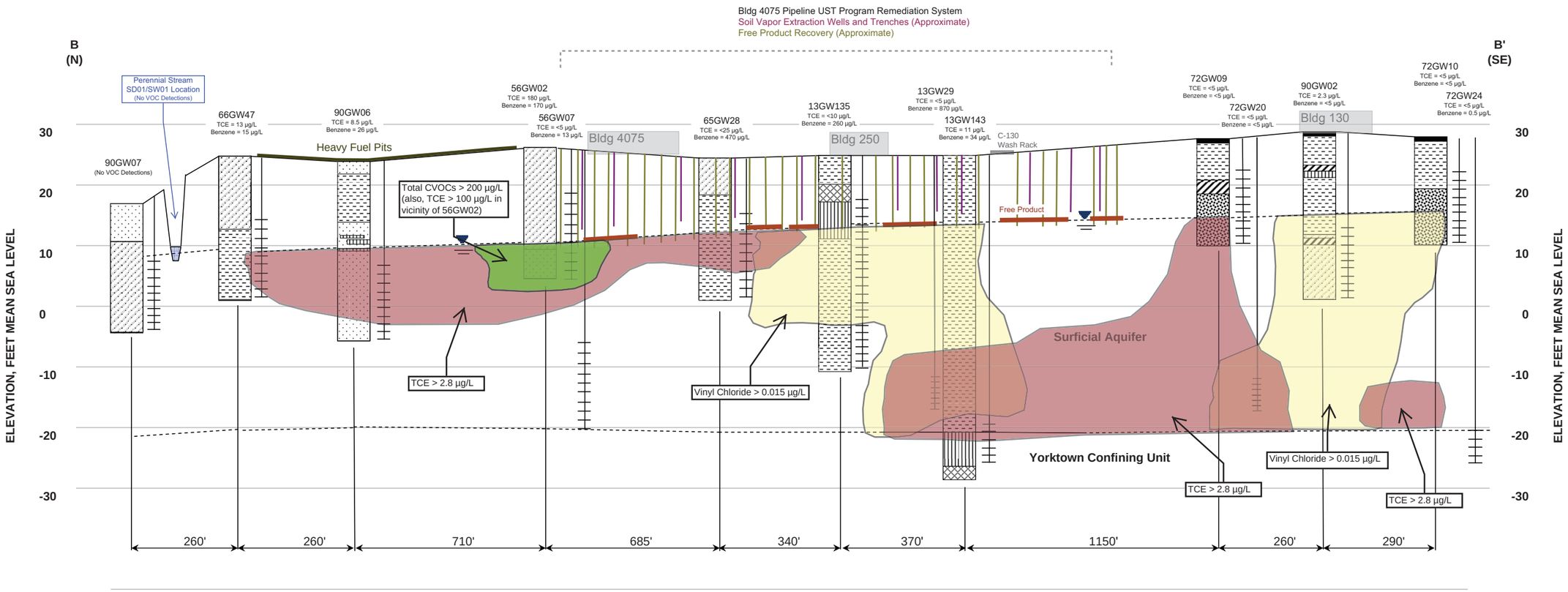
- Total CVOCs > 200 µg/L
- TCE > 2.8 µg/L (NC2L)
- VC > 0.015 µg/L (NC2L)
- POL Free Product
- Soil Vapor Extraction Wells and Trenches (Approximate)
- Free Product Recovery (Approximate)
- MONITORING WELL SCREENED INTERVAL
- GROUND WATER TABLE

STRATIGRAPHY

- HYDROSTRATIGRAPHIC CONTACT
- HYDROSTRATIGRAPHIC CONTACT (INFERRED)

Figure 5-7
Interpretive Cross-Section A-A'
OU14, Site 90 Remedial Investigation
MCAS Cherry Point
North Carolina

CH2MHILL



Notes:
(1) This cross-section is interpretive and was prepared by interpolation between boring locations. Actual conditions between borings may differ from those shown here.
(2) Isocontours are interpretive and intended to provide an approximate visual snapshot of conditions in the Surficial Aquifer.
(3) UST Remediation System component locations are approximate.
(4) Structure locations and sizes are approximate.

Lithology/USCS Description

- Asphalt/Concrete/Fill
- SW: Well Graded Sands
- SP: Poorly Graded Sands
- SM: Silty Sands
- SC: Clayey Sands
- CL: Inorganic Clays (Low Plasticity)
- CH: Inorganic Clays (High Plasticity)
- OL: Organic Silts (Low Plasticity)
- Soil Vapor Extraction Wells and Trenches (Approximate)
- Free Product Recovery (Approximate)

Legend

- Monitoring Well Screened Interval
- Groundwater Table
- Hydrostratigraphic Contact
- Hydrostratigraphic Contact (Inferred from other nearby boring logs)
- Total CVOCs > 200 µg/L
- POL Free Product
- TCE > 2.8 µg/L (NC2L)
- VC > 0.015 µg/L (NC2L)

Figure 5-8
Interpretive Cross-Section B-B'
OU14, Site 90 Remedial Investigation
MCAS Cherry Point
North Carolina

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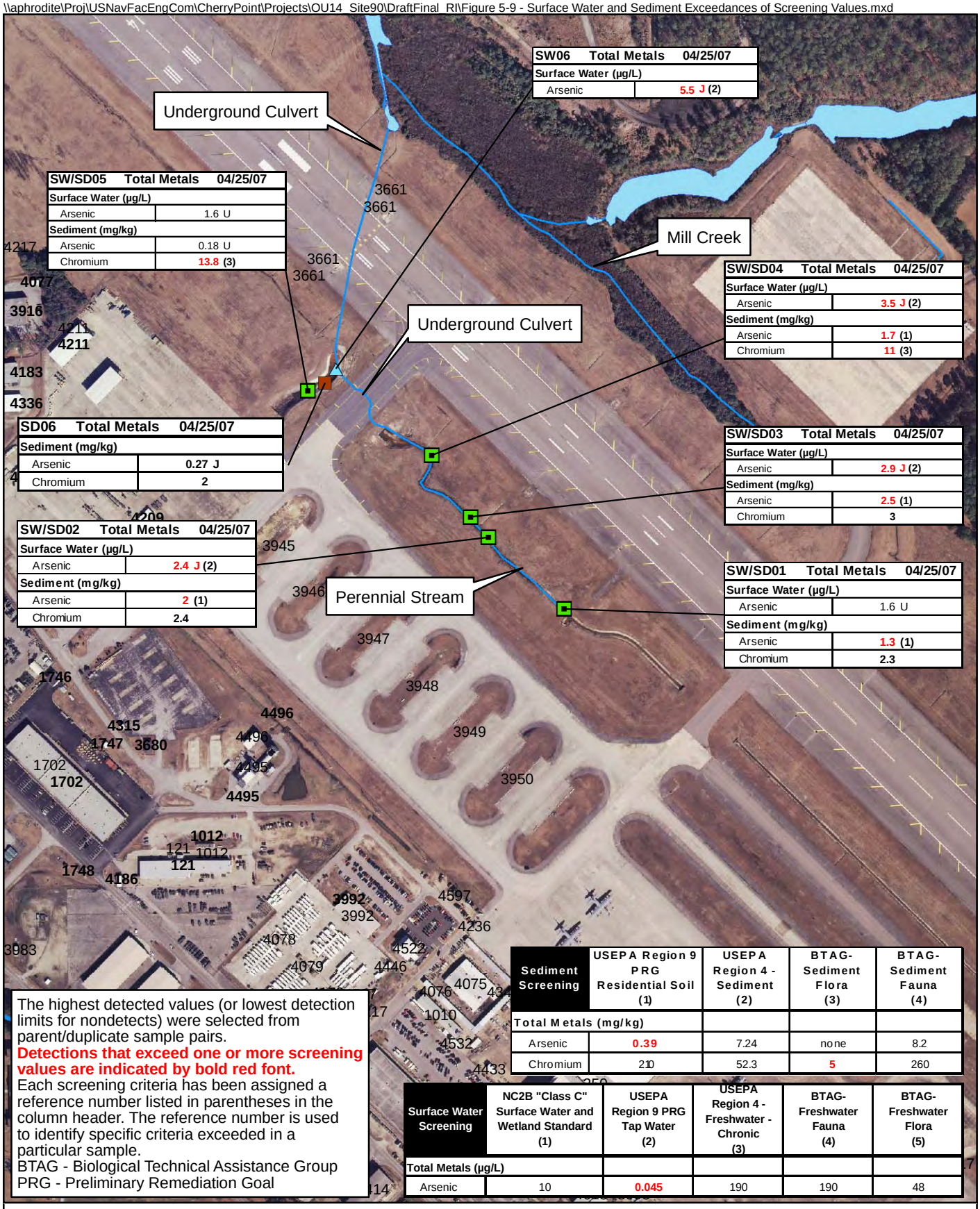

SW06 Total Metals 04/25/07	
Surface Water (µg/L)	
Arsenic	5.5 J (2)

SW/SD05 Total Metals 04/25/07	
Surface Water (µg/L)	
Arsenic	1.6 U
Sediment (mg/kg)	
Arsenic	0.18 U
Chromium	13.8 (3)

SW/SD04 Total Metals 04/25/07	
Surface Water (µg/L)	
Arsenic	3.5 J (2)
Sediment (mg/kg)	
Arsenic	1.7 (1)
Chromium	11 (3)

SD06 Total Metals 04/25/07	
Sediment (mg/kg)	
Arsenic	0.27 J
Chromium	2

SW/SD03 Total Metals 04/25/07	
Surface Water (µg/L)	
Arsenic	2.9 J (2)
Sediment (mg/kg)	
Arsenic	2.5 (1)
Chromium	3

SW/SD02 Total Metals 04/25/07	
Surface Water (µg/L)	
Arsenic	2.4 J (2)
Sediment (mg/kg)	
Arsenic	2 (1)
Chromium	2.4

SW/SD01 Total Metals 04/25/07	
Surface Water (µg/L)	
Arsenic	1.6 U
Sediment (mg/kg)	
Arsenic	1.3 (1)
Chromium	2.3

Sediment Screening	USEPA Region 9 PRG Residential Soil (1)	USEPA Region 4 - Sediment (2)	BTAG-Sediment Flora (3)	BTAG-Sediment Fauna (4)
Total Metals (mg/kg)				
Arsenic	0.39	7.24	none	8.2
Chromium	210	52.3	5	260

Surface Water Screening	NC2B "Class C" Surface Water and Wetland Standard (1)	USEPA Region 9 PRG Tap Water (2)	USEPA Region 4 - Freshwater - Chronic (3)	BTAG-Freshwater Fauna (4)	BTAG-Freshwater Flora (5)
Total Metals (µg/L)					
Arsenic	10	0.045	190	190	48

The highest detected values (or lowest detection limits for nondetects) were selected from parent/duplicate sample pairs.
Detections that exceed one or more screening values are indicated by bold red font.
Each screening criteria has been assigned a reference number listed in parentheses in the column header. The reference number is used to identify specific criteria exceeded in a particular sample.
BTAG - Biological Technical Assistance Group
PRG - Preliminary Remediation Goal

Legend
- Sediment Sample
- Surface Water
- Collocated Surface Water/Sediment Sample
- Water Bodies and Streams
- Intermittent Water Body
- Permanent Water Body

N W E S

0 250 500 Feet

Figure 5-9
Surface Water and Sediment Exceedances of RI Screening Values
Operable Unit 14, Site 90 Remedial Investigation
MCAS Cherry Point
North Carolina

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OU14 RI
Appendix G

Raw Analytical Data

Table G-1a
Subsurface Soil Raw Analytical Data
MCAS Cherry Point, North Carolina

Station Identification	9006SB	9007SB	9008SB	9009SB	9021SB		9024SB	9025SB	9026SB	9027SB	OU14-SB01	OU14-SB02	OU14-SB03	OU14-SB04		OU14-SB05	OU14-SB06	OU14-SB08	OU14-SB09
Sample Identification	9006SB0203	9007SB0607	9008SB0203	9009SB0708	9021SB0506	9021SB0506P	9024SB0203	9025SB1011	9026SB0607	9027SB0607	OU14-SB01-1012-05A	OU14-SB02-1012-05A	OU14-SB03-1517-05A	OU14-SB04-1012-05A	OU14-SB04P-1012-05A	OU14-SB05-1517-05A	OU14-SB06-2022-05A	OU14-SB08-0507-05A	OU14-SB09-0911-05A
Sample Date	10/17/02	10/18/02	10/17/02	10/17/02	10/21/02	10/21/02	10/22/02	10/22/02	10/22/02	10/22/02	02/15/05	02/15/05	02/16/05	02/21/05	02/21/05	02/23/05	02/23/05	02/21/05	02/18/05
Volatile Organic Compounds (µg/kg)																			
1,1,1-Trichloroethane	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
1,1,2,2-Tetrachloroethane	4.6 U	4.7 U	4.9 U	3,200 J	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
1,1,2-Trichloroethane	4.6 U	4.7 U	4.9 U	2,500 J	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
1,1-Dichloroethane	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
1,1-Dichloroethylene	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
1,2,4-Trichlorobenzene	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
1,2-Dibromo-3-chloropropane	4.6 U	4.7 U	4.9 U	3,900 J	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
1,2-Dibromoethane	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
1,2-Dichlorobenzene	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
1,2-Dichloroethane	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
1,2-Dichloropropane	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
1,3-Dichlorobenzene	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
1,4-Dichlorobenzene	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
2-Butanone	8.5 J	9.5 U	10	5,800 J	10 U	9.6 U	9.8 U	15 U	11 UJ	12 U	33	21	11 J	730 U	1,000 U	14 U	8.4 J	14 U	710 U
2-Hexanone	9.2 U	9.5 U	9.8 U	19,000	10 U	9.6 U	9.8 U	15 U	11 UJ	12 U	19 U	15 U	19 U	730 U	1,000 U	14 U	16 U	11 U	710 U
4-Methyl-2-pentanone	9.2 U	9.5 U	9.8 U	53,000	10 U	9.6 U	9.8 U	15 U	11 UJ	12 U	19 U	15 U	19 U	730 U	1,000 U	14 U	16 U	11 U	710 U
Acetone	48	9.5 U	51	25,000	12 U	9.6 U	49	15 U	72 J	34 J	99	100	34	730 U	1,000 U	18	22	22	710 U
Benzene	4.6 U	4.7 U	4.9 U	8,000	5 U	4.8 U	5.1	210	43 J	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
Bromodichloromethane	4.6 U	4.7 U	4.9 U	3,200 J	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
Bromoform	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
Bromomethane	9.2 U	9.5 U	9.8 U	12,000 U	10 U	9.6 U	9.8 U	15 U	11 UJ	12 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
Carbon disulfide	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	28	12	12	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
Carbon tetrachloride	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
Chlorobenzene	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
Chloroethane	9.2 U	9.5 U	9.8 U	12,000 U	10 U	9.6 U	9.8 U	15 U	11 UJ	12 U	7.5 U	6 U	7.5 U	290 UJ	400 UJ	5.7 UJ	6.4 UJ	4.6 U	280 UJ
Chloroform	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	6.2	4.8 J	4.6 U	280 U
Chloromethane	9.2 U	9.5 U	9.8 U	12,000 U	10 U	3.6 J	4.7 J	7.7 J	8.5 J	12 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
cis-1,2-Dichloroethylene	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.2 J	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
cis-1,3-Dichloropropene	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
Cumene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.5 U	6 U	7.5 U	320 J	400 UJ	5.7 U	6.4 U	4.6 U	1,100
Cyclohexane	4.6 U	4.7 U	11	520,000	10 J	83 J	260 J	7.3 U	520 J	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
Dibromochloromethane	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
Dichlorodifluoromethane (Freon-12)	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	6.1 J	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
Ethylbenzene	4.6 U	4.7 U	1.9 J	56,000	5 U	4.8 U	520 J	300 J	1,800 J	1,600 J	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	740
isopropylbenzene	4.6 U	4.7 U	4.9 U	8,400	5 U	4.8 U	190	32	550 J	200 J	NA	NA	7.5 U	NA	NA	NA	NA	NA	NA
Methyl acetate	4.6 U	4.7 U	4.9 U	800,000	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
Methylcyclohexane	4.6 U	4.7 U	21	46,000	6.3 J	58 J	1,700 J	900 J	2,000 J	NA	7.5 U	6 U	7.5 U	660	820	5.7 U	6.4 U	4.6 U	170 J
Methylene chloride	9.2 U	9.5 U	9.8 U	12,000 U	10 U	9.6 U	9.8 U	15 U	11 U	12 U	1.9 J	1.4 J	1.7 J	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
Methyl-tert-butyl ether (MTBE)	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
Styrene	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.3 U	36 J	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
Tetrachloroethylene	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
Toluene	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	8.1	560 J	4.5 J	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
trans-1,2-Dichloroethylene	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
trans-1,3-Dichloropropene	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
Trichloroethylene	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.3 U	5.5 U	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
Trichlorofluoromethane(Freon-11)	4.6 U	4.7 U	4.9 U	6,200 U	5 U	4.8 U	4.9 U	7.3 U	5.5 UJ	6.1 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
Vinyl chloride	9.2 U	9.5 U	9.8 U	12,000 U	10 U	9.6 U	9.8 U	15 U	11 UJ	12 U	7.5 U	6 U	7.5 U	290 U	400 U	5.7 U	6.4 U	4.6 U	280 U
Xylene, total	2 J	4.6 J	6.1	160,000	3.9 J	4.8 U	610 J	160	1,900 J	1,400 J	23 U	18 U	23 U	220 J	120 J	17 U	19 U	14 U	1,300
Wet Chemistry (mg/kg)																			
% Solids	89	90	85	80	84	NA	79	83	81	85	NA	NA		NA	NA	NA	NA	NA	NA

Notes:
U- Analyte not detected
J- Reported value is estimated
UJ- Analyte not detected. Quantitation limit is imprecise

Station Identification	OU14-SB10	OU14-SB11	OU14-SB12	OU14-SB13		OU14-SB14	OU14-SB15	OU14-SB16	
Sample Identification	OU14-SB10-2325-05A	OU14-SB11-2830-05A	OU14-SB12-4951-05A	OU14-SB13-1012-05A	OU14-SB13P-1012-05A	OU14-SB14-0305-05A	OU14-SB15-1315-05A	OU14-SB16P-3335-05A	OU14-SB16-3335-05A
Sample Date	02/23/05	02/25/05	02/18/05	02/16/05	02/16/05	02/25/05	02/22/05	02/21/05	02/22/05
Volatile Organic Compounds (µg/kg)									
1,1,1-Trichloroethane	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
1,1,2,2-Tetrachloroethane	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
1,1,2-Trichloroethane	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
1,1-Dichloroethane	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
1,1-Dichloroethylene	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
1,2,4-Trichlorobenzene	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
1,2-Dibromo-3-chloropropane	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
1,2-Dibromoethane	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
1,2-Dichlorobenzene	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
1,2-Dichloroethane	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
1,2-Dichloropropane	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
1,3-Dichlorobenzene	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
1,4-Dichlorobenzene	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
2-Butanone	12 U	13 U	15	18	15 J	24 J	11 J	13 J	23 J
2-Hexanone	12 U	13 U	8.5 U	16 U	16 U	13 U	13 U	14 U	15 U
4-Methyl-2-pentanone	12 U	13 U	8.5 U	16 U	16 U	13 U	13 U	14 U	15 U
Acetone	22	22	31	45	46	160 J	21	22	29
Benzene	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	1.3 J	0.94 J	0.73 J
Bromodichloromethane	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
Bromoform	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
Bromomethane	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
Carbon disulfide	4.9 U	25	6.4	10	12	1.8 J	5.2 U	5 J	3.4 J
Carbon tetrachloride	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
Chlorobenzene	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
Chloroethane	4.9 UJ	5.2 UJ	3.4 U	6.6 U	6.6 U	5.2 UJ	5.2 UJ	5.5 UJ	5.8 UJ
Chloroform	4.9 U	3.2 J	3.4 U	6.6 U	6.6 U	5.2 U	1.5 J	5.5 U	1.6 J
Chloromethane	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
cis-1,2-Dichloroethylene	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
cis-1,3-Dichloropropene	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
Cumene	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
Cyclohexane	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
Dibromochloromethane	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
Dichlorodifluoromethane (Freon-12)	4.9 U	5.2 U	3.4 U	2.5 J	6.6 U	5.2 U	5.2 U	1.4 J	5.8 U
Ethylbenzene	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
isopropylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl acetate	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
Methylcyclohexane	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
Methylene chloride	4.9 U	5.2 U	3.4 U	6.6 U	1.5 J	5.2 U	5.2 U	5.5 U	5.8 U
Methyl-tert-butyl ether (MTBE)	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
Styrene	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
Tetrachloroethylene	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
Toluene	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
trans-1,2-Dichloroethylene	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
trans-1,3-Dichloropropene	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
Trichloroethylene	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
Trichlorofluoromethane(Freon-11)	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
Vinyl chloride	4.9 U	5.2 U	3.4 U	6.6 U	6.6 U	5.2 U	5.2 U	5.5 U	5.8 U
Xylene, total	15 U	16 U	10 U	20 U	20 U	33 J	15 U	17 U	17 U
Wet Chemistry (mg/kg)									
% Solids	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
U- Analyte not detected
J- Reported value is estimated
UJ- Analyte not detected. Quantitation limit is imprecise

Table G-1b
Subsurface Soil Raw Analytical Data
for "New SVE" (9009SB) 09/24/08
Operable Unit 14
MCAS Cherry Point, North Carolina

Site	Location	Sample_ID	Lab_ID	Matrix	Date_Samp	Samp_Time	LAB	Method	CAS	Parameter	Result	DET_Limit	Data_Qualifier	Units	CONC_FACTOR	TOT_DIS
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	630-20-6	1,1,1,2-Tetrachloroethane		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	71-55-6	1,1,1-Trichloroethane		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	79-34-5	1,1,2,2-Tetrachloroethane		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	79-00-5	1,1,2-Trichloroethane		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	75-34-3	1,1-Dichloroethane		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	75-35-4	1,1-Dichloroethene		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	563-58-6	1,1-Dichloropropene		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	87-61-6	1,2,3-Trichlorobenzene		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	96-18-4	1,2,3-Trichloropropane		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	120-82-1	1,2,4-Trichlorobenzene		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	120-82-1	1,2,4-Trichlorobenzene		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	95-63-6	1,2,4-Trimethylbenzene	19800	2270		UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	96-12-8	1,2-Dibromo-3-chloropropane		11400	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	106-93-4	1,2-Dibromoethane (EDB)		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	95-50-1	1,2-Dichlorobenzene		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	95-50-1	1,2-Dichlorobenzene		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	107-06-2	1,2-Dichloroethane		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	78-87-5	1,2-Dichloropropane		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	108-67-8	1,3,5-Trimethylbenzene	6090	2270		UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	541-73-1	1,3-Dichlorobenzene		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	541-73-1	1,3-Dichlorobenzene		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	142-28-9	1,3-Dichloropropane		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	106-46-7	1,4-Dichlorobenzene		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	106-46-7	1,4-Dichlorobenzene		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	594-20-7	2,2-Dichloropropane		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	95-95-4	2,4,5-Trichlorophenol		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	88-06-2	2,4,6-Trichlorophenol		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	120-83-2	2,4-Dichlorophenol		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	105-67-9	2,4-Dimethylphenol		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	51-28-5	2,4-Dinitrophenol		30800	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	121-14-2	2,4-Dinitrotoluene		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	606-20-2	2,6-Dinitrotoluene		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	78-93-3	2-Butanone		56800	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	91-58-7	2-Chloronaphthalene		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	95-57-8	2-Chlorophenol		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	95-49-8	2-Chlorotoluene		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	591-78-6	2-Hexanone		11400	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	91-57-6	2-Methylnaphthalene	90800	6170		ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	95-48-7	2-Methylphenol		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	88-74-4	2-Nitroaniline		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	88-75-5	2-Nitrophenol		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	108-39-4	3- & 4-Methylphenol		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	91-94-1	3,3'-Dichlorobenzidine		12300	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	99-09-2	3-Nitroaniline		30800	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	534-52-1	4,6-Dinitro-2-methylphenol		30800	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	101-55-3	4-bromophenyl phenyl ether		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	59-50-7	4-Chloro-3-methylphenol		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	106-47-8	4-Chloroaniline		30800	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	7005-72-3	4-Chlorophenyl phenyl ether		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	106-43-4	4-Chlorotoluene		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	99-87-6	4-Isopropyltoluene	2930	2270		UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	108-10-1	4-Methyl-2-pentanone		11400	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	100-01-6	4-Nitroaniline		30800	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	100-02-7	4-Nitrophenol		30800	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	83-32-9	Acenaphthene		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	208-96-8	Acenaphthylene		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	67-64-1	Acetone		56800	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	120-12-7	Anthracene		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	71-43-2	Benzene		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	56-55-3	Benzo[a]anthracene		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	50-32-8	Benzo[a]pyrene		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	205-99-2	Benzo[b]fluoranthene		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	191-24-2	Benzo[g,h,i]perylene		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	207-08-9	Benzo[k]fluoranthene		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	65-85-0	Benzoic Acid		12300	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	111-91-1	Bis(2-chloroethoxy)methane		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	111-44-4	Bis(2-chloroethyl)ether		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	108-60-1	Bis(2-chloroisopropyl)ether		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	117-81-7	Bis(2-ethylhexyl)phthalate		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	108-86-1	Bromobenzene		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	74-97-5	Bromochloromethane		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	75-27-4	Bromodichloromethane		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	75-25-2	Bromoform		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	74-83-9	Bromomethane		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	85-68-7	Butylbenzylphthalate		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	75-15-0	Carbon disulfide		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	56-23-5	Carbon tetrachloride		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	108-90-7	Chlorobenzene		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	75-00-3	Chloroethane		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	67-66-3	Chloroform		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	74-87-3	Chloromethane		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	218-01-9	Chrysene		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	156-59-2	cis-1,2-Dichloroethene		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	10061-01-5	cis-1,3-Dichloropropene		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	53-70-3	Dibenzo[a,h]anthracene		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	132-64-9	Dibenzofuran		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	124-48-1	Dibromochloromethane		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	74-95-3	Dibromomethane		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	75-71-8	Dichlorodifluoromethane		11400	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	84-66-2	Diethylphthalate		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	108-20-3	Diisopropyl ether (DIPE)		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	131-11-3	Dimethylphthalate		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	84-74-2	Di-n-Butylphthalate		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	117-84-0	Di-n-octylphthalate		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	122-39-4	Diphenylamine *		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	100-41-4	Ethylbenzene	5180	2270		UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	206-44-0	Fluoranthene		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	86-73-7	Fluorene		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	118-74-1	Hexachlorobenzene		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	87-68-3	Hexachlorobutadiene		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	87-68-3	Hexachlorobutadiene		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	77-47-4	Hexachlorocyclopentadiene		12300	U	ug/Kg	20	T

Table G-1b
Subsurface Soil Raw Analytical Data
for "New SVE" (9009SB) 09/24/08
Operable Unit 14
MCAS Cherry Point, North Carolina

OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	67-72-1	Hexachloroethane		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	193-39-5	Indeno(1,2,3-c,d)pyrene		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	74-88-4	Iodomethane		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	78-59-1	Isophorone		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	98-82-8	Isopropylbenzene		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	108-38-3	m-,p-Xylene	14000	4550		UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	75-09-2	Methylene chloride		11400	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	1634-04-4	Methyl-tert-butyl ether (MTBE)		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	91-20-3	Naphthalene	18100	2270		UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	91-20-3	Naphthalene	56700	6170		ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	104-51-8	n-Butylbenzene	7980	2270		UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	98-95-3	Nitrobenzene		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	621-64-7	N-Nitrosodi-n-propylamine		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	103-65-1	n-Propyl benzene	2590	2270		UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	95-47-6	o-Xylene		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	87-86-5	Pentachlorophenol		30800	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	85-01-8	Phenanthrene		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	108-95-2	Phenol		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1F	Soil	9/24/2008	13:00	SGS	SW8270	129-00-0	Pyrene		6170	U	ug/Kg	20	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	135-98-8	sec-Butylbenzene	3480	2270		UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	100-42-5	Styrene		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	98-06-6	tert-Butylbenzene		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	127-18-4	Tetrachloroethene		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	108-88-3	Toluene		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	156-60-5	trans-1,2-dichloroethene		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	10061-02-6	trans-1,3-Dichloropropene		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	110-57-6	trans-1,4-Dichloro-2-butene		11400	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	79-01-6	Trichloroethene		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	75-69-4	Trichlorofluoromethane		2270	U	UG/KG	2000	T
OU14	9009SB	New SVE	G894-99-1D	Soil	9/24/2008	13:00	SGS	SW8260	75-01-4	Vinyl chloride		2270	U	UG/KG	2000	T

Table G-2
Direct Push Technology Groundwater Raw Analytical Data
MCAS Cherry Point, North Carolina

Station Identification	9001GW		9002GW		9003GW		9004GW		9005GW	9006GW			9007GW		
Sample Identification	9001GW1216	9001GW3640	9002GW1216	9002GW3640	9003GW1216	9003GW3640	9004GW1216	9004GW4044	9005GW1216	9006GW1216	9006GW4044	9006GW4044-P	9007GW1216	9007GW1216P	9007GW4044
Sample Date	10/16/02	10/16/02	10/16/02	10/16/02	10/16/02	10/16/02	10/21/02	10/21/02	10/21/02	10/17/02	10/17/02	10/17/02	10/18/02	10/18/02	10/18/02
Volatile Organic Compounds (µg/L)															
1,1,1-Trichloroethane	1 U	5 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	1 U	5 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	1 U	5 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	51	10	3.9	8	720	5.2	10	1 U	7.6	1 U	8.1	9	1 U	1 U	15
1,1-Dichloroethylene	0.67 J	5 U	1 U	2.2	38	5 U	1 U	1 U	1 U	1 U	1 U	0.7 J	1 U	1 U	1 U
1,2,4-Trichlorobenzene	1 U	5 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-chloropropane	1 U	5 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromoethane	1 U	5 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	1 U	5 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	1 U	5 U	1 U	1 U	4	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1 U	5 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	1 U	5 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	1 U	5 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	5 U	25 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone	5 U	25 U	5 U	5 U	4.6 J	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone	5 U	25 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	5 U	25 U	5 U	12	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	3.1	150	1.4	1 U	9.4	9.2	0.76 J	1 U	600	1 U	8.7	11	1 U	1 U	250
Bromochloromethane	1 U	5 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	1 U	5 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	1 U	5 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	1 U	5 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon disulfide	1 U	5 U	3.1 U	1 U	1.3	5 U	1.1	0.96 J	1 U	1 U	1 U	1 U	1.5 U	1 U	1 U
Carbon tetrachloride	1 U	5 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	1 U	5 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	6.9	5 U	1 U	1 U	47	5 U	1 U	1 U	9.1	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	1 U	5 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane	1 U	5 U	2.6	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cumene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyclohexane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibromochloromethane	1 U	5 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane (Freon-12)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	1 U	140	1 U	1 U	2.3	130	1 U	1 U	66	1 U	1 U	1 U	1 U	1 U	1.9
Methyl acetate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl-tert-butyl ether (MTBE)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylcyclohexane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	1.5 U	14 U	1.3 U	1.5 U	2 U	14 U	1.2 U	1.3 U	2 U	1 U	2.5 U	1 U	1 U	1 U	1 U
Styrene	1 U	5 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethylene	1 U	5 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	1 U	5 U	1 U	1 U	5.3	5 U	1 U	1 U	7.7	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethylene	1 U	5 U	0.55 J	0.67 J	1 U	5 U	1 U	24	1 U	0.64 J	1.2	1.2	1 U	1 U	1 U
Trichlorofluoromethane(Freon-11)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	28	5 U	1 U	1 U	850	5 U	1.9	1 U	1.6	1 U	1 U	1 U	1 U	1 U	1 U
Xylene, total	1 U	5 U	1 U	1 U	17	5 U	1 U	1 U	980	1 U	1 U	1 U	1 U	1 U	2.4
cis-1,2-Dichloroethylene	5.9	5 U	6.4	1 U	150	5 U	1.8	7.2	1 U	0.54 J	2.9	3.9	1 U	1 U	1.3
cis-1,3-Dichloropropene	1 U	5 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethylene	1 U	5 U	1 U	1 U	3.2	5 U	1 U	0.7 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	1 U	5 U	1 U	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

NA - Not analyzed
U - Analyte not detected
J - Reported value is estimated
UJ - Not detected, quantitation limit may be inaccurate
R - Value rejected by data validator; unusable result

Station Identification	9008GW		9009GW		9010GW		9011GW	9012GW		9013GW		9014GW		9015GW	
Sample Identification	9008GW0812	9008GW4448	9009GW0812	9009GW4448	9010GW4448	9010GW1216	9011GW4448	9012GW1216	9012GW4650	9013GW1216	9013GW4650	9014GW1216	9014GW4050	9015GW1216	9015GW4650
Sample Date	10/18/02	10/18/02	10/17/02	10/17/02	10/17/02	10/17/02	10/17/02	10/20/02	10/20/02	10/18/02	10/18/02	10/18/02	10/18/02	10/18/02	10/18/02
Volatile Organic Compounds (µg/L)															
1,1,1-Trichloroethane	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	1 U	1.2	25 U	25 U	30	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethylene	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-chloropropane	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromoethane	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	5 U	5 U	130 U	130 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone	5 U	5 U	130 U	130 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone	5 U	5 U	130 U	130 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	4.1 J	5 U	130 U	130 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	3.1 J	5 U	5 U
Benzene	16	16	210	25 J	2.5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	9	1 U
Bromochloromethane	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon disulfide	2.6 U	1.3 U	20 J	88	1 U	1 U	2.3 U	1 U	2	1 U	1.3 U	1 U	1.6 U	2.9 U	2.8 U
Carbon tetrachloride	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane	1 U	1 U	25 U	21 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.4	1 U
Cumene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyclohexane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibromochloromethane	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane (Freon-12)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	12	1	160	30	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl acetate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl-tert-butyl ether (MTBE)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylcyclohexane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	1 U	1 U	36	37	2.3 U	2.1 U	1 U	1.2 U	1.1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethylene	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethylene	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane(Freon-11)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	0.56 J	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylene, total	12	2	250	77	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethylene	1 U	35	25 U	57	8.8	1 U	1.8	1 U	1 U	1 U	1 U	1 U	1 U	42	1 U
cis-1,3-Dichloropropene	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethylene	1 U	7.5	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.8	1 U
trans-1,3-Dichloropropene	1 U	1 U	25 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

NA - Not analyzed
U - Analyte not detected
J - Reported value is estimated
UJ - Not detected, quantitation limit may be inaccurate
R - Value rejected by data validator; unusable result

Table G-2
Direct Push Technology Groundwater Raw Analytical Data
MCAS Cherry Point, North Carolina

Station Identification	9016GW		9017GW			9018GW		9019GW		9020GW		9021GW	
Sample Identification	9016GW1216	9016GW4448	9017GW4448	9017GW1216	9017GW1216P	9018GW1216	9018GW4650	9019GW1216	9019GW4650	9020GW1216	9020GW3640	9021GW1216	9021GW4044
Sample Date	10/20/02	10/20/02	10/20/02	10/20/02	10/20/02	10/20/02	10/20/02	10/20/02	10/21/02	10/21/02	10/21/02	10/21/02	10/21/02
Volatile Organic Compounds (µg/L)													
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	1 U	1 U	3.1	1 U	1 U	1 U	18	6.4	52	28	11	1 U	0.99 J
1,1-Dichloroethylene	1 U	1 U	1.3	1 U	1 U	1 U	2.2	1 U	2.2	1 U	5.5	1 U	1 U
1,2,4-Trichlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-chloropropane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromoethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10
Benzene	3.7	1 U	4	0.56 J	0.56 J	1 U	2.3	1 U	2.5	1,000	1,500	140	58
Bromochloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon disulfide	0.73 J	3.1	5.1	1.4	1.5	1 U	3.3	1 U	1.4	0.88 J	2.7	1 U	1.9
Carbon tetrachloride	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cumene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyclohexane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibromochloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane (Freon-12)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	4.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	160	97	1 U	0.73 J
Methyl acetate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl-tert-butyl ether (MTBE)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylcyclohexane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	1.6 U	1.6 U	1.3 U	2.5 U	2.6 U	1.5 U	1.2 U	1.2 U	1.2 U	1.9 U	1.2 U	1 U	1.2 U
Styrene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethylene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	39	3 U	8.5	1.1 U
Trichloroethylene	1 U	1 U	69	1 U	1 U	1 U	16	1 U	12	1 U	1 U	1 U	1 U
Trichlorofluoromethane(Freon-11)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	0.69 J	1 U	2.7	1.6	1.6	1 U	2.4	1 U	1 U	1 U	1 U	1 U	1 U
Xylene, total	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1,800	38	190	1.1
cis-1,2-Dichloroethylene	9.3	1 U	130	43	43	1 U	300	2.7	54	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethylene	1 U	1 U	16	3.2	3.3	1 U	33	1 U	3.1	1 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

NA - Not analyzed
U - Analyte not detected
J - Reported value is estimated
UJ - Not detected, quantitation limit may be inaccurate
R - Value rejected by data validator; unusable result

Table G-2
Direct Push Technology Groundwater Raw Analytical Data
MCAS Cherry Point, North Carolina

Station Identification	9022GW			9023GW		9024GW			9025GW		9026GW		9027GW	
Sample Identification	9022GW1216P	9022GW1216	9022GW4650	9023GW1216	9023GW4448	9024GW1216P	9024GW1216	9024GW4650	9025GW1216	9025GW4044	9026GW1216	9026GW4448	9027GW1216	9027GW4448
Sample Date	10/20/02	10/20/02	10/20/02	10/22/02	10/22/02	10/22/02	10/22/02	10/22/02	10/22/02	10/22/02	10/22/02	10/22/02	10/22/02	10/22/02
Volatile Organic Compounds (µg/L)														
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U	1 U	75	1 U	1 U	1 U	1 U	1 U	1 U	1.9	1 U	1 U
1,1-Dichloroethylene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-chloropropane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromoethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	28	1 U	1 U	1 U
1,2-Dichloropropane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	5 U	5 U	5 U	5 U	6.8	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	1 U	1 U	1.9	73	27	410	440	19	210	290	1,100	19	150	170
Bromochloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon disulfide	16	6.2	6.7	1 U	1.2 U	1 U	1 U	1 U	1 U	1 U	1.1	1 U	1 U	1 U
Carbon tetrachloride	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cumene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyclohexane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibromochloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane (Freon-12)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	1 U	1 U	1 U	43	1 U	25	22	8.8	11	4	120	69	170	32
Methyl acetate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl-tert-butyl ether (MTBE)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylcyclohexane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	1.3 U	1.3 U	1.3 U	3.3 U	2.7 U	2.6 U	2.8 U	3 U	3.1 U	3.7 U	2.3 U	2.7 U	2 U	2.7 U
Styrene	1 U	1 U	1 U	0.87 J	1 U	1 U	1 U	1 U	1 U	1 U	2.5	1.3	1 U	1 U
Tetrachloroethylene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	1 U	1 U	1 U	8.3	1 U	1 U	1 U	1 U	1.1 U	1 U	18	12	1 U	1 U
Trichloroethylene	1 U	1 U	20	1 U	0.65 J	1 U	1 U	1.1	1 U	2.5	1 U	3	1 U	1 U
Trichlorofluoromethane(Freon-11)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylene, total	1 U	1 U	1 U	97	0.54 J	110	120	23	1.5	5.9	660	170	16	15
cis-1,2-Dichloroethylene	0.75 J	0.77 J	32	0.66 J	170	1 U	1 U	90	1.5	7.1	1.2	6.8	1 U	12
cis-1,3-Dichloropropene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethylene	1 U	1 U	4.1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

NA - Not analyzed
U - Analyte not detected
J - Reported value is estimated
UJ - Not detected, quantitation limit may be inaccurate
R - Value rejected by data validator; unusable result

Station Identification	OU14-90GW02					OU14-90GW04					
Sample Identification	OU14-90GW02-1520-05B	OU14-90GW02-2025-05B	OU14-90GW02-3035-05B	OU14-90GW02-3540-05B	OU14-90GW02-4045-05B	OU14-90GW04-1520-05B	OU14-90GW04-2025-05B	OU14-90GW04P-2025-05B	OU14-90GW04-3035-05B	OU14-90GW04-3540-05B	OU14-90GW04-4045-05B
Sample Date	04/13/05	04/13/05	04/13/05	04/13/05	04/13/05	04/13/05	04/13/05	04/13/05	04/13/05	04/13/05	04/13/05
Volatile Organic Compounds (µg/L)											
1,1,1-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	5.2	5.4	10	4.8 J	4.5 J	5 U	5 U	5 U	5 U	3.2 J	32
1,1-Dichloroethylene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	3.5 J	5 U	5 U	5 U	5 U	3.3 J	5 U	5 U	5 U	5 U	5 U
1,2-Dibromo-3-chloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromoethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2.2 J
1,2-Dichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,3-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,4-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	13 U	13 U	13 U	13 U	13 U	22	13 U	13 U	13 U	13 U	13 U
2-Hexanone	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U
4-Methyl-2-pentanone	13 U	13 U	13 U	13 U	13 U	6.6 J	13 U	13 U	13 U	13 U	13 U
Acetone	3 J	13 U	13 U	13 U	13 U	140	13 U	13 U	13 U	3 J	7.8 J
Benzene	5 U	1.2 J	5 U	5 U	5 U	34	5.9	5.8	5.2	48	120
Bromochloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromoform	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromomethane	5 R	5 R	5 R	5 R	5 R	5 R	5 R	5 R	5 R	5 R	5 R
Carbon disulfide	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1.3 J	5 U	5 U	5 U
Carbon tetrachloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	5 U	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ
Cumene	5 U	5 U	5 U	5 U	5 U	20	2.3 J	2.7 J	2.2 J	8.7	5.7
Cyclohexane	5 U	5 U	5 U	5 U	5 U	3.1 J	1.6 J	1.3 J	32	13	12
Dibromochloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane (Freon-12)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5 U	5 U	5 U	5 U	5 U	95	2.5 J	2.9 J	1.9 J	21	30
Methyl acetate	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl-tert-butyl ether (MTBE)	5 U	5 U	5 U	5 U	5 U	5 U	83 J	87 J	5 U	1.2 J	3 J
Methylcyclohexane	5 U	5 U	5 U	5 U	5 U	4.7 J	1.6 J	1.7 J	5.8	3.3 J	1.1 J
Methylene chloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Styrene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethylene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	5 U	5 U	5 U	5 U	5 U	56	5 U	5 U	5 U	5 U	1.8 J
Trichloroethylene	8.1	1.7 J	5 U	0.49 J	1.6 J	5 U	11	10	13	37	11
Trichlorofluoromethane(Freon-11)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl chloride	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	5.7
Xylene, total	5 U	5 U	5 U	5 U	5 U	300	9.9	11	5 U	1.1 J	1.4 J
cis-1,2-Dichloroethylene	18	19	0.45 J	5 U	0.34 J	5 U	2.9 J	2.7 J	4.2 J	61	190
cis-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,2-Dichloroethylene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1 J	1.9 J
trans-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U

NA - Not analyzed
U - Analyte not detected
J - Reported value is estimated
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R - Value rejected by data validator; unusable result

Station Identification	OU14-90GW05					OU14-90GW09				
Sample Identification	OU14-90GW05-1520-05B	OU14-90GW05-2025-05B	OU14-90GW05-3035-05B	OU14-90GW05-3540-05B	OU14-90GW05-4045-05B	OU14-90GW09-1520-05B	OU14-90GW09-2025-05B	OU14-90GW09P-2025-05B	OU14-90GW09-3035-05B	OU14-90GW09-4045-05B
Sample Date	04/12/05	04/12/05	04/12/05	04/12/05	04/12/05	04/11/05	04/11/05	04/11/05	04/11/05	04/11/05
Volatile Organic Compounds (µg/L)										
1,1,1-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2.7 J	2 J
1,1-Dichloroethylene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromo-3-chloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromoethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	5 U	5 U	1.2 J	2.8 J	6.3	5 U	5 U	5 U	5 U	1.1 J
1,2-Dichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,3-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,4-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	2.9 J	13 U	13 U	13 U	15	13 U	13 U	13 U	13 U	13 U
2-Hexanone	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U
4-Methyl-2-pentanone	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U
Acetone	11 J	13 U	13 U	6 J	31	4.4 J	4.5 J	4.9 J	3.1 J	12 J
Benzene	5 U	5 U	5 U	5 U	5 U	5 U	1.9 J	1.8 J	2.4 J	5 U
Bromochloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromoform	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromomethane	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 R	5 UJ	5 UJ	5 R	5 UJ
Carbon disulfide	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2.2 J
Carbon tetrachloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5 U	5 U	5 U	5 U	3.6 J	5 U	5 U	5 U	5 U	5 U
Chloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Cumene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Cyclohexane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane (Freon-12)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1.4 J
Methyl acetate	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl-tert-butyl ether (MTBE)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methylcyclohexane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methylene chloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Styrene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethylene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	5 U	1.1 J	1.9 J	1.4 J	2.6 J	5 U	5 U	5 U	5 U	5 U
Trichloroethylene	1.5 J	2.4 J	2 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichlorofluoromethane(Freon-11)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl chloride	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Xylene, total	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2 J
cis-1,2-Dichloroethylene	1.5 J	2.3 J	23	4.4 J	5 U	5 U	3.7 J	3.7 J	8.2	5 U
cis-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,2-Dichloroethylene	5 U	1.4 J	4.5 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U

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Station Identification	OU14-90GW13						OU14-90GW15					
Sample Identification	OU14-90GW13-1216-05B	OU14-90GW13P-1216-05B	OU14-90GW13-1621-05B	OU14-90GW13-2631-05B	OU14-90GW13-3136-05B	OU14-90GW13-3641-05B	OU14-90GW15-1318-05B	OU14-90GW15-1823-05B	OU14-90GW15-2328-05B	OU14-90GW15-2833-05B	OU14-90GW15P-2833-05B	OU14-90GW15-3338-05B
Sample Date	04/13/05	04/13/05	04/13/05	04/13/05	04/13/05	04/13/05	04/12/05	04/12/05	04/12/05	04/12/05	04/12/05	04/12/05
Volatile Organic Compounds (µg/L)												
1,1,1-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	5 U	5 U	5 U	5 U	1.8 J	29	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethylene	5 U	5 U	5 U	5 U	5 U	2.6 J	5 U	5 U	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	3.3 J	3.8 J	5 U	5 U	5 U	5 U
1,2-Dibromo-3-chloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromoethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,3-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,4-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U
2-Hexanone	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U
4-Methyl-2-pentanone	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U
Acetone	3.2 J	2.6 J	2.6 J	13 U	2.8 J	13 U	13 U	4.1 J	13 U	3.9 J	3.9 J	13 U
Benzene	5 U	5 U	5 U	5 U	2.5 J	7.7	160	1.7 J	10	1.4 J	1.3 J	5 U
Bromochloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromoform	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromomethane	5 R	5 R	5 R	5 R	5 R	84 R	8.4 R	5 R	5 R	5 R	5 R	5 R
Carbon disulfide	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1.5 J	5 U	5 U	2.4 J	1.3 J
Carbon tetrachloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 U	5 UJ	5 UJ	5 UJ	5 UJ
Cumene	2.4 J	2.2 J	5 U	5 U	5 U	5 U	69	1.9 J	13	5 U	5 U	5 U
Cyclohexane	1.1 J	1 J	5 U	5 U	5 U	5 U	180	11	94	5 U	5 U	5 U
Dibromochloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane (Freon-12)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl acetate	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl-tert-butyl ether (MTBE)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methylcyclohexane	5 U	5 U	5 U	5 U	5 U	5 U	170	7.9	82	5 U	5 U	5 U
Methylene chloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Styrene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethylene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethylene	5 U	5 U	5 U	5 U	4.1 J	30	1.1 J	5 U	2.3 J	17	15	1.9 J
Trichlorofluoromethane(Freon-11)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl chloride	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Xylene, total	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethylene	5 U	5 U	5 U	5.5	49	1,800	5 U	5 U	5 U	3 J	2.9 J	5 U
cis-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,2-Dichloroethylene	5 U	5 U	5 U	5 U	5 U	12	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U

NA - Not analyzed
U - Analyte not detected
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Table G-2
Direct Push Technology Groundwater Raw Analytical Data
MCAS Cherry Point, North Carolina

Station Identification	OU14-90GW16					OU14-90GW18				
Sample Identification	OU14-90GW16-1621-05B	OU14-90GW16-2631-05B	OU14-90GW16-3136-05B	OU14-90GW16-3641-05B	OU14-90GW16-2126-05B	OU14-90GW18-1520-05B	OU14-90GW18-2025-05B	OU14-90GW18-2530-05B	OU14-90GW18-3035-05B	OU14-90GW18-3540-05B
Sample Date	04/12/05	04/12/05	04/12/05	04/12/05	04/21/05	04/11/05	04/11/05	04/11/05	04/11/05	04/11/05
Volatile Organic Compounds (µg/L)										
1,1,1-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.9	18	46
1,1-Dichloroethylene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1.5 J
1,2,4-Trichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromo-3-chloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromoethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,3-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,4-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	2.9 J	13 U	21	6.7 J	13 U	13 U	13 U	13 U	13 U	13 U
2-Hexanone	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U
4-Methyl-2-pentanone	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U
Acetone	6.2 J	2.6 J	59	15	4.9 J	11 J	4.6 J	2.7 J	7 J	4 J
Benzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1.1 J	3.4 J	5.5
Bromochloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromoform	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromomethane	5 UJ	5 R	5 R	5 R	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ
Carbon disulfide	1.2 J	5 U	5 U	5 U	5 U	1.7 J	1.3 J	5 U	5 U	5 U
Carbon tetrachloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	2.1 J	5 U	5.8	5 U	1 J	1.1 J	5 U	5 U	5 U	5 U
Chloromethane	5 U	5 UJ	5 UJ	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U
Cumene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	4.2 J	3.3 J
Cyclohexane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane (Freon-12)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	8.3	7.7
Methyl acetate	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl-tert-butyl ether (MTBE)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methylcyclohexane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2.6 J	1.5 J
Methylene chloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Styrene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethylene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	5 U	5 U	1.5 J	1.7 J	1.2 J	5 U	5 U	5 U	5 U	5 U
Trichloroethylene	5 U	1.1 J	4.3 J	1.4 J	5 U	5 U	5 U	5 U	1.2 J	1.5 J
Trichlorofluoromethane(Freon-11)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl chloride	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Xylene, total	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	25	25
cis-1,2-Dichloroethylene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	9.5	51	99
cis-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,2-Dichloroethylene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U

NA - Not analyzed
U - Analyte not detected
J - Reported value is estimated
UJ - Not detected, quantitation limit may be inaccurate
R - Value rejected by data validator; unusable result

Table G-3
Upper Surficial Aquifer Groundwater Raw Analytical Data
MCAS Cherry Point, North Carolina

Station Identification	OU1-MW61		OU14-13GW05	OU14-13GW12		OU14-13GW120A	OU14-13GW135	OU14-13GW17		OU14-13GW19	OU14-13GW20	OU14-13GW21
Sample Identification	OU1-MW61-03D	OU1-MW61-05B	OU14-13GW05-03D	OU14-13GW12-03D	OU14-13GW12-05B	OU14-13GW120A-03D	OU14-13GW135-03D	OU14-13GW17-03D	OU14-13GW17-05B	OU14-13GW19-03D	OU14-13GW20-03D	OU14-13GW21-05B
Sample Date	10/22/03	04/21/05	10/23/03	10/30/03	04/20/05	10/28/03	10/24/03	10/28/03	04/20/05	10/28/03	10/28/03	04/19/05
Volatile Organic Compounds (µg/L)												
1,1,1-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	5 U	5 U	5 U	5 U	5 U	23	10 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	170	19	5 U	8	46	5 U	10 U	1 J	5 U	5 U	5 U	5 U
1,1-Dichloroethylene	0.3 J	1 J	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromo-3-chloropropane	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromoethane	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	1 J	5 U	5 U	5 U	5 U	5 U	1 J	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethylene (total)	4 J	3 J	10 U	6 J	NA	10 U	3 J	8 J	NA	10 U	10 U	NA
1,2-Dichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
1,3-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
1,4-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	5 U	13 U	5 R	5 R	13 U	5 R	50 U	5 R	13 U	5 R	5 R	13 U
2-Hexanone	5 U	13 U	5 U	5 U	13 U	5 U	50 U	5 U	13 U	5 U	5 U	13 U
4-Methyl-2-pentanone	5 U	13 U	5 U	5 U	13 U	5 U	50 U	5 U	13 U	5 U	5 U	13 U
Acetone	5 R	13 U	5 R	5 R	13 U	5 R	50 U	5 R	9.1 J	5 R	5 R	15 U
Benzene	8	6.1	5 U	5 U	5 U	1 J	260	2 J	5 U	0.5 J	5 U	5 U
Bromodichloromethane	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
Bromoform	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
Bromomethane	5 U	5 R	5 U	5 U	5 UJ	5 U	10 U	5 U	5 U	5 U	5 U	5 R
Carbon disulfide	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
Carbon tetrachloride	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	4 J	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	5 U	5 U	5 U	5 U	5 UJ	5 U	3 J	5 U	5 U	5 U	5 U	5 U
Cumene	5 U	5 U	5 U	5 U	5 U	1 J	16	5 U	5 U	5 U	5 U	2.3 J
Cyclohexane	6	1.1 J	5 U	5 U	5 U	5 U	14	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane (Freon-12)	5 U	5 U	5 U	5 U	5 U	2 J	10 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	1 J	2.2 J	5 U	5 U	5 U	2 J	70	1 J	0.53 J	0.5 J	5 U	5.5
Methyl acetate	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
Methyl-tert-butyl ether (MTBE)	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
Methylcyclohexane	4 J	5 U	5 U	5 U	5 U	5 U	9 J	5 U	5 U	5 U	5 U	5 U
Methylene chloride	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
Styrene	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethylene	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
Toluene	1 J	5 U	5 U	5 U	5 U	5 U	4 J	5 U	5 U	5 U	5 U	5 U
Trichloroethylene	5 U	1 J	5 U	5	16 J	5 U	10 U	5 U	5 U	5 U	5 U	5 U
Trichlorofluoromethane(Freon-11)	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
Vinyl chloride	110	12	5 U	0.4 J	2 U	5 U	10 U	5 U	5 U	5 U	5 U	2 U
Xylene, total	2 J	5 U	15 U	15 U	5 U	15 U	180	0.7 J	5 U	15 U	15 U	5 U
cis-1,2-Dichloroethylene	3 J	3 J	1 J	6	20	5 U	3 J	8	5 U	5 U	5 U	5 U
cis-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
m- and p-Xylene	0.6 J	5 U	10 U	10 U	NA	10 U	110	0.7 J	NA	10 U	10 U	NA
o-Xylene	1 J	5 U	5 U	5 U	NA	5 U	70	5 U	NA	5 U	5 U	NA
trans-1,2-Dichloroethylene	1 J	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
trans-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U
Dissolved Gases (mg/L)												
Methane	NA	0.24	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethane	NA	0.002 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethene	NA	3.00E-04 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (µg/L)												
Arsenic	8.2	NA	3.9 J	2.13 U	NA	4.9 J	6 J	2.13 U	NA	2.5 J	2.13 U	NA

Table G-3
Upper Surficial Aquifer Groundwater Raw Analytical Data
MCAS Cherry Point, North Carolina

Station Identification	OU1-MW61		OU14-13GW05	OU14-13GW12		OU14-13GW120A	OU14-13GW135	OU14-13GW17		OU14-13GW19	OU14-13GW20	OU14-13GW21
Sample Identification	OU1-MW61-03D	OU1-MW61-05B	OU14-13GW05-03D	OU14-13GW12-03D	OU14-13GW12-05B	OU14-13GW120A-03D	OU14-13GW135-03D	OU14-13GW17-03D	OU14-13GW17-05B	OU14-13GW19-03D	OU14-13GW20-03D	OU14-13GW21-05B
Sample Date	10/22/03	04/21/05	10/23/03	10/30/03	04/20/05	10/28/03	10/24/03	10/28/03	04/20/05	10/28/03	10/28/03	04/19/05
Barium	82.6	NA	44.2	57.8	NA	34.3	71	65.7	NA	73.3	22	NA
Cadmium	3 J	NA	0.25 U	0.26 J	NA	0.25 U	0.35 J	0.25 U	NA	0.43 J	0.25 U	NA
Chromium	1.4 J	NA	1 J	0.88 U	NA	1.8 J	2.6 J	0.88 U	NA	1.4 J	0.88 U	NA
Iron	NA	9,730	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	1.56 U	NA	1.56 U	1.56 U	NA	1.56 U	4.3 J	1.56 U	NA	1.56 U	1.56 U	NA
Manganese	NA	44.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	0.04 U	NA	0.04 U	0.04 U	NA	0.05 J	0.04 UJ	0.04 UJ	NA	0.04 UJ	0.04 J	NA
Selenium	3.4 J	NA	2.32 U	2.32 U	NA	2.32 UJ	2.32 U	2.32 UJ	NA	2.32 UJ	2.32 UJ	NA
Silver	1.16 U	NA	1.16 U	1.16 U	NA	1.16 U	1.16 U	1.16 U	NA	1.16 U	1.16 U	NA
Wet Chemistry (mg/L)												
Chloride	NA	11.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate	0.05 U	0.15	0.05 U	0.05 U	NA	0.05 U	0.05 U	0.076	NA	0.05 U	0.11	NA
Nitrite	NA	0.075	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	11	26.1	14	86	NA	210	6.5	59	NA	57	83	NA
Sulfide	NA	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC)	NA	9.52	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA - Not analyzed
U - Analyte not detected
J - Reported value is estimated
UJ - Not detected, quantitation limit may be inaccurate
R - Unreliable Result

Table G-3
Upper Surficial Aquifer Groundwater Raw Analytical Data
MCAS Cherry Point, North Carolina

Station Identification	OU14-13GW25	OU14-56GW02		OU14-56GW06	OU14-56GW13	OU14-56GW23	OU14-66GW02	OU14-66GW03	OU14-66GW05	OU14-66GW06	OU14-66GW07		OU14-66GW10	
Sample Identification	OU14-13GW25-05B	OU14-56GW02-03D	OU14-56GW02-05B	OU14-56GW06-03D	OU14-56GW13-03D	OU14-56GW23-03D	OU14-66GW02-05B	OU14-66GW03-05B	OU14-66GW05-03D	OU14-66GW06-03D	OU14-66GW07P-03D	OU14-66GW07-03D	OU14-66GW10-03D	OU14-66GW10P-03D
Sample Date	04/20/05	10/29/03	04/21/05	10/27/03	10/24/03	10/28/03	04/19/05	04/19/05	10/30/03	10/30/03	10/30/03	10/30/03	10/29/03	10/29/03
Volatile Organic Compounds (µg/L)														
1,1,1-Trichloroethane	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	5 U	3 J	4.3 J	5 U	25 U	0.6 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethylene	5 U	5 U	1.3 J	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromo-3-chloropropane	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromoethane	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichlorobenzene	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	5 U	7	3.6 J	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethylene (total)	NA	24	NA	10 U	50 U	10 U	NA	NA	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichloropropane	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,3-Dichlorobenzene	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,4-Dichlorobenzene	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	13 U	5 R	13 U	25 U	120 U	5 R	13 U	13 U	5 R	5 R	5 R	5 R	5 R	5 R
2-Hexanone	13 U	5 U	13 U	25 U	120 U	5 U	13 U	13 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone	13 U	5 U	13 U	25 U	120 U	5 U	13 U	13 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	13 U	5 R	13 U	25 U	120 U	5 R	82 U	20 U	5 R	5 R	5 R	5 R	5 R	5 R
Benzene	1.9 J	160	170	5 U	330	0.2 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromodichloromethane	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromoform	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromomethane	5 U	5 U	5 UJ	5 U	25 U	5 U	5 UJ	5 R	5 U	5 U	5 U	5 U	5 U	5 U
Carbon disulfide	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon tetrachloride	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	5 U	5 U	5 UJ	5 U	25 U	5 U	5 UJ	5.7 U	5 U	5 U	5 U	5 U	5 U	5 U
Cumene	3 J	0.5 J	1.1 J	5 U	97	5 U	4.2 J	5 U	5 U	0.3 J	5 U	5 U	5 U	5 U
Cyclohexane	5 U	7	14	5 U	460	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane (Freon-12)	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	0.89 J	0.8 J	5 U	0.1 J	230	5 U	19	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl acetate	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl-tert-butyl ether (MTBE)	5 U	2 J	1.6 J	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methylcyclohexane	5 U	5 U	5 U	5 U	320	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methylene chloride	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Styrene	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethylene	5 U	1 J	5 U	0.5 J	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	5 U	5 U	5 U	5 U	32	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethylene	5 U	150	180 J	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichlorofluoromethane(Freon-11)	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl chloride	5 U	5 U	2 U	5 U	25 U	5 U	2 U	2 U	5 U	5 U	5 U	5 U	5 U	5 U
Xylene, total	5 U	15 U	5 U	15 U	960	15 U	3.6 J	5 U	15 U	15 U	15 U	15 U	15 U	15 U
cis-1,2-Dichloroethylene	5 U	24	30	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,3-Dichloropropene	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
m- and p-Xylene	NA	10 U	NA	10 U	800	10 U	NA	NA	10 U	10 U	10 U	10 U	10 U	10 U
o-Xylene	NA	5 U	NA	5 U	160	5 U	NA	NA	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,2-Dichloroethylene	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,3-Dichloropropene	5 U	5 U	5 U	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dissolved Gases (mg/L)														
Methane	NA	NA	0.69	NA	NA	NA	0.079	NA	NA	NA	NA	NA	NA	NA
Ethane	NA	NA	0.003	NA	NA	NA	0.002 U	NA	NA	NA	NA	NA	NA	NA
Ethene	NA	NA	0.002 U	NA	NA	NA	1.00E-04 J	NA	NA	NA	NA	NA	NA	NA
Total Metals (µg/L)														
Arsenic	NA	2.13 U	NA	2.13 U	39.3	2.13 U	NA	NA	2.8 J	42.4	2.13 U	2.13 U	2.13 U	2.13 U

Table G-3
Upper Surficial Aquifer Groundwater Raw Analytical Data
MCAS Cherry Point, North Carolina

Station Identification	OU14-13GW25	OU14-56GW02		OU14-56GW06	OU14-56GW13	OU14-56GW23	OU14-66GW02	OU14-66GW03	OU14-66GW05	OU14-66GW06	OU14-66GW07		OU14-66GW10	
Sample Identification	OU14-13GW25-05B	OU14-56GW02-03D	OU14-56GW02-05B	OU14-56GW06-03D	OU14-56GW13-03D	OU14-56GW23-03D	OU14-66GW02-05B	OU14-66GW03-05B	OU14-66GW05-03D	OU14-66GW06-03D	OU14-66GW07P-03D	OU14-66GW07-03D	OU14-66GW10-03D	OU14-66GW10P-03D
Sample Date	04/20/05	10/29/03	04/21/05	10/27/03	10/24/03	10/28/03	04/19/05	04/19/05	10/30/03	10/30/03	10/30/03	10/30/03	10/29/03	10/29/03
Barium	NA	49.8	NA	49.9	11.6	56.8	NA	NA	24.8	21.5	10	10.2	13.8	13.8
Cadmium	NA	0.25 U	NA	0.25 U	0.84 J	0.25 U	NA	NA	0.43 J	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Chromium	NA	2.5 J	NA	0.88 U	0.88 U	0.88 U	NA	NA	1.9 J	0.93 J	0.88 U	1 J	0.88 U	0.88 U
Iron	NA	NA	4,680	NA	NA	NA	541	NA	NA	NA	NA	NA	NA	NA
Lead	NA	1.56 U	NA	1.56 U	3.5 J	1.56 U	NA	NA	14.6	2.2 J	2.1 J	1.56 U	1.56 U	1.56 U
Manganese	NA	NA	67.6	NA	NA	NA	17	NA	NA	NA	NA	NA	NA	NA
Mercury	NA	0.07 J	NA	0.04 J	0.04 UJ	0.04 UJ	NA	NA	0.04 U	0.04 U	0.04 U	0.05 J	0.05 J	0.07 J
Selenium	NA	3 J	NA	2.32 U	2.32 U	2.32 UJ	NA	NA	2.32 U	2.32 U	3.4 J	3.1 J	2.32 UJ	2.32 UJ
Silver	NA	1.16 U	NA	1.16 U	1.16 U	1.16 U	NA	NA	1.16 U	1.16 U	1.16 U	1.16 U	1.16 U	1.16 U
Wet Chemistry (mg/L)														
Chloride	NA	NA	12.4	NA	NA	NA	4.15	NA	NA	NA	NA	NA	NA	NA
Nitrate	NA	0.05 U	0.435	0.2	0.05 U	0.26	0.025 J	NA	0.16	0.05 U	0.73	0.26	0.05 U	0.05 U
Nitrite	NA	NA	0.05 U	NA	NA	NA	0.05	NA	NA	NA	NA	NA	NA	NA
Sulfate	NA	45	39	42	1 U	68	14.9	NA	16	1 U	7.4	7.7	7.6	6.6
Sulfide	NA	NA	1 U	NA	NA	NA	16.8	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC)	NA	NA	10.8	NA	NA	NA	43.1	NA	NA	NA	NA	NA	NA	NA

NA - Not analyzed
U - Analyte not detected
J - Reported value is estimated
UJ - Not detected, quantitation limit may be inaccurate
R - Unreliable Result

Table G-3
Upper Surficial Aquifer Groundwater Raw Analytical Data
MCAS Cherry Point, North Carolina

Station Identification	OU14-66GW20	OU14-66GW28		OU14-66GW34		OU14-66GW35	OU14-66GW36	OU14-66GW37		OU14-66GW47		OU14-66GW49	OU14-72GW02
Sample Identification	OU14-66GW20-03D	OU14-66GW28-03D	OU14-66GW28-05B	OU14-66GW34-03D	OU14-66GW34-05B	OU14-66GW35-05B	OU14-66GW36-05B	OU14-66GW37P-03D	OU14-66GW37-03D	OU14-66GW47-03D	OU14-66GW47-05B	OU14-66GW49-05B	OU14-72GW02-03D
Sample Date	10/24/03	10/29/03	04/15/05	10/29/03	04/19/05	04/19/05	04/19/05	10/29/03	10/29/03	10/28/03	04/19/05	04/20/05	10/23/03
Volatile Organic Compounds (µg/L)													
1,1,1-Trichloroethane	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	5 U	25 U	25 U	19	26	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethylene	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	5 U	25 U	20 J	5 U	5 U	5 U	3.7 J	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromo-3-chloropropane	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromoethane	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichlorobenzene	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethylene (total)	10 U	50 U	NA	5 J	NA	NA	NA	10 U	10 U	2 J	NA	NA	10 U
1,2-Dichloropropane	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,3-Dichlorobenzene	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,4-Dichlorobenzene	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	25 U	25 R	63 U	5 R	13 U	13 U	13 U	5 R	5 R	5 R	13 U	13 U	5 R
2-Hexanone	25 U	25 U	63 U	5 U	13 U	13 U	13 U	5 U	5 U	5 U	13 U	13 U	5 U
4-Methyl-2-pentanone	25 U	25 U	63 U	5 U	13 U	13 U	13 U	5 U	5 U	5 U	13 U	13 U	5 U
Acetone	25 U	25 R	63 U	5 R	13 U	13 U	13 U	5 R	5 R	5 R	13 U	13 U	5 R
Benzene	0.2 J	310	470	2 J	5 U	10	3.1 J	5 U	5 U	2 J	15	5 U	5 U
Bromodichloromethane	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromoform	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromomethane	5 U	25 U	25 R	5 U	5 UJ	5 R	5 UJ	5 U	5 U	5 U	5 UJ	5 U	5 U
Carbon disulfide	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon tetrachloride	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	5 U	25 U	25 U	5 U	5 UJ	5 U	5 UJ	5 U	5 U	5 U	5 UJ	5 U	5 U
Cumene	5 U	7 J	25 U	1 J	5 U	7.2	4.9 J	5 U	5 U	5 U	5 U	5 U	5 U
Cyclohexane	5 U	23 J	21 J	5 U	5 U	18	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane (Freon-12)	5 U	25 U	25 U	5 U	5 U	5 U	5 U	2 J	2 J	5 U	5 U	5 U	5 U
Ethylbenzene	0.2 J	78	76	0.8 J	5 U	2.9 J	21	5 U	5 U	5 U	5 U	5 U	5 U
Methyl acetate	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl-tert-butyl ether (MTBE)	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methylcyclohexane	5 U	9 J	25 U	5 U	5 U	6.4	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methylene chloride	5 U	7 J	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Styrene	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethylene	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	5 U	65	98	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethylene	5 U	25 U	25 U	4 J	2.6 J	19 J	5 U	5 U	5 U	8	13 J	5 U	5 U
Trichlorofluoromethane(Freon-11)	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 J	5 J	5 U	5 U	5 U	5 U
Vinyl chloride	5 U	25 U	10 U	0.6 J	2 U	2 U	2 U	5 U	5 U	5 U	2 U	5 U	5 U
Xylene, total	15 U	75	110	15 U	5 U	5 U	11	15 U	15 U	15 U	5 U	5 U	15 U
cis-1,2-Dichloroethylene	5 U	3 J	25 U	3 J	5 U	6.5	5 U	5 U	5 U	5 U	3.3 J	5 U	5 U
cis-1,3-Dichloropropene	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
m- and p-Xylene	0.3 J	45 J	NA	10 U	NA	NA	NA	10 U	10 U	10 U	NA	NA	10 U
o-Xylene	5 U	30	NA	5 U	NA	NA	NA	5 U	5 U	5 U	NA	NA	5 U
trans-1,2-Dichloroethylene	5 U	25 U	25 U	2 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,3-Dichloropropene	5 U	25 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dissolved Gases (mg/L)													
Methane	NA	NA	NA	NA	0.034	NA	0.021	NA	NA	NA	0.033	NA	NA
Ethane	NA	NA	NA	NA	0.002 U	NA	0.002 U	NA	NA	NA	0.002 U	NA	NA
Ethene	NA	NA	NA	NA	0.002 U	NA	0.002 U	NA	NA	NA	0.002 U	NA	NA
Total Metals (µg/L)													
Arsenic	2.3 J	2.13 U	NA	2.13 U	NA	NA	NA	2.13 U	2.13 U	69.9	NA	NA	2.13 U

Table G-3
Upper Surficial Aquifer Groundwater Raw Analytical Data
MCAS Cherry Point, North Carolina

Station Identification	OU14-66GW20	OU14-66GW28		OU14-66GW34		OU14-66GW35	OU14-66GW36	OU14-66GW37		OU14-66GW47		OU14-66GW49	OU14-72GW02
Sample Identification	OU14-66GW20-03D	OU14-66GW28-03D	OU14-66GW28-05B	OU14-66GW34-03D	OU14-66GW34-05B	OU14-66GW35-05B	OU14-66GW36-05B	OU14-66GW37P-03D	OU14-66GW37-03D	OU14-66GW47-03D	OU14-66GW47-05B	OU14-66GW49-05B	OU14-72GW02-03D
Sample Date	10/24/03	10/29/03	04/15/05	10/29/03	04/19/05	04/19/05	04/19/05	10/29/03	10/29/03	10/28/03	04/19/05	04/20/05	10/23/03
Barium	42.5	23.3	NA	56	NA	NA	NA	78.1	79.3	35.6	NA	NA	100
Cadmium	0.25 U	0.25 U	NA	0.25 U	NA	NA	NA	0.25 U	0.25 U	0.25 U	NA	NA	0.25 U
Chromium	0.88 U	3.5 J	NA	2.6 J	NA	NA	NA	1.3 J	0.88 U	1.5 J	NA	NA	0.88 U
Iron	NA	NA	NA	NA	2,760	NA	761	NA	NA	NA	49,200	NA	NA
Lead	1.56 U	2.4 J	NA	7.3	NA	NA	NA	5 J	5	1.56 U	NA	NA	1.56 U
Manganese	NA	NA	NA	NA	73.4	NA	33.5	NA	NA	NA	64.8	NA	NA
Mercury	0.05 J	0.04 UJ	NA	0.04 J	NA	NA	NA	0.06 J	0.04 UJ	0.04 J	NA	NA	0.04 U
Selenium	2.32 U	2.32 UJ	NA	5.1 J	NA	NA	NA	2.32 UJ	2.8 J	2.32 UJ	NA	NA	2.32 U
Silver	1.16 U	1.16 U	NA	1.16 U	NA	NA	NA	1.16 U	1.16 U	1.16 U	NA	NA	1.16 U
Wet Chemistry (mg/L)													
Chloride	NA	NA	NA	NA	5.28	NA	6.85	NA	NA	NA	5.94	NA	NA
Nitrate	1.3	0.26	NA	0.57	0.335	NA	0.05 U	3.2	3.2	0.059	0.05 U	NA	0.05 U
Nitrite	NA	NA	NA	NA	0.05 U	NA	0.05 U	NA	NA	NA	0.05 U	NA	NA
Sulfate	25	38	NA	130	145	NA	27.8	79	83	92	64	NA	62 J
Sulfide	NA	NA	NA	NA	1 U	NA	10.6	NA	NA	NA	1 U	NA	NA
Total organic carbon (TOC)	NA	NA	NA	NA	32.3	NA	8.93	NA	NA	NA	18.8	NA	NA

NA - Not analyzed
U - Analyte not detected
J - Reported value is estimated
UJ - Not detected, quantitation limit may be inaccurate
R - Unreliable Result

Table G-3
Upper Surficial Aquifer Groundwater Raw Analytical Data
MCAS Cherry Point, North Carolina

Station Identification	OU14-72GW04	OU14-72GW06	OU14-72GW09	OU14-72GW10		OU14-72GW14	OU14-72GW15		OU14-72GW18	OU14-72GW21		OU14-72GW26
Sample Identification	OU14-72GW04-03D	OU14-72GW06-03D	OU14-72GW09-03D	OU14-72GW10-03D	OU14-72GW10-05B	OU14-72GW14-03D	OU14-72GW15P-03D	OU14-72GW15-03D	OU14-72GW18-03D	OU14-72GW21-03D	OU14-72GW21-05B	OU14-72GW26-03D
Sample Date	10/22/03	10/23/03	10/24/03	10/23/03	04/21/05	10/23/03	10/22/03	10/22/03	10/31/03	10/30/03	04/20/05	10/23/03
Volatile Organic Compounds (µg/L)												
1,1,1-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	14	5 U	5 U	0.4 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethylene	0.4 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromo-3-chloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromoethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethylene (total)	2 J	10 U	10 U	5 J	NA	10 U	10 U	10 U	10 U	3 J	NA	10 U
1,2-Dichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,3-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,4-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	5 U	5 R	25 U	5 R	13 U	5 R	5 U	5 U	5 R	5 R	13 U	5 R
2-Hexanone	5 U	5 U	25 U	5 U	13 U	5 U	5 U	5 U	5 U	5 U	13 U	5 U
4-Methyl-2-pentanone	5 U	5 U	25 U	5 U	13 U	5 U	5 U	5 U	5 U	5 U	13 U	5 U
Acetone	5 R	5 R	25 U	5 R	3.7 J	5 R	5 R	5 R	5 R	5 R	13 U	5 R
Benzene	70	5 U	5 U	0.3 J	5 U	5 U	0.7 J	0.7 J	5 U	1 J	5 U	5 U
Bromodichloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromoform	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromomethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U
Carbon disulfide	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon tetrachloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U
Cumene	64	5 U	5 U	5 U	5 U	5 U	2 J	2 J	5 U	5 U	5 U	5 U
Cyclohexane	92	5 U	5 U	5 U	5 U	5 U	4 J	5 J	5 U	5 U	5 U	5 U
Dibromochloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane (Freon-12)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	9	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl acetate	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl-tert-butyl ether (MTBE)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	0.4 J	5 U	5 U
Methylcyclohexane	20	5 U	5 U	5 U	5 U	5 U	3 J	3 J	5 U	5 U	5 U	5 U
Methylene chloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Styrene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethylene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	0.6 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethylene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichlorofluoromethane(Freon-11)	5 U	1 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl chloride	28	5 U	5 U	5 U	2 U	5 U	5 U	5 U	5 U	4 J	2 U	5 U
Xylene, total	18	15 U	15 U	15 U	5 U	15 U	15 U	15 U	15 U	15 U	5 U	15 U
cis-1,2-Dichloroethylene	2 J	5 U	5 U	5 J	5 U	5 U	0.6 J	0.6 J	5 U	3 J	7	5 U
cis-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
m- and p-Xylene	16	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	NA	10 U
o-Xylene	2 J	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	NA	5 U
trans-1,2-Dichloroethylene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dissolved Gases (mg/L)												
Methane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.14	NA
Ethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.002 U	NA
Ethene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.00E-05 J	NA
Total Metals (µg/L)												
Arsenic	40	2.13 U	2.13 U	22.4	NA	2.13 U	2.13 U	3.4 J	5.1 J	6 J	NA	6.6 J

Table G-3
Upper Surficial Aquifer Groundwater Raw Analytical Data
MCAS Cherry Point, North Carolina

Station Identification	OU14-72GW04	OU14-72GW06	OU14-72GW09	OU14-72GW10		OU14-72GW14	OU14-72GW15		OU14-72GW18	OU14-72GW21		OU14-72GW26
Sample Identification	OU14-72GW04-03D	OU14-72GW06-03D	OU14-72GW09-03D	OU14-72GW10-03D	OU14-72GW10-05B	OU14-72GW14-03D	OU14-72GW15P-03D	OU14-72GW15-03D	OU14-72GW18-03D	OU14-72GW21-03D	OU14-72GW21-05B	OU14-72GW26-03D
Sample Date	10/22/03	10/23/03	10/24/03	10/23/03	04/21/05	10/23/03	10/22/03	10/22/03	10/31/03	10/30/03	04/20/05	10/23/03
Barium	64.8	87.1	42.6	64.5	NA	61.4	31	30.1	12.9	59.7	NA	124
Cadmium	0.28 J	0.25 U	0.25 U	0.25 U	NA	0.25 U	0.25 U	0.25 U	0.39 J	0.25 U	NA	0.25 U
Chromium	1 J	0.88 U	0.88 U	0.88 U	NA	0.88 U	0.97 J	1.5 J	0.88 U	2.3 J	NA	0.88 U
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6,140	NA
Lead	1.56 U	1.8 U	1.56 U	1.56 U	NA	1.56 U	1.56 U	1.56 U	1.56 U	1.56 U	NA	1.56 U
Manganese	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	59.6	NA
Mercury	0.04 U	0.04 U	0.04 UJ	0.04 U	NA	0.04 J	0.04 U	0.04 U	0.05 J	0.04 U	NA	0.04 U
Selenium	2.32 U	2.32 U	2.32 U	2.32 U	NA	3.1 J	2.32 U	2.32 U	2.8 J	2.32 U	NA	2.32 U
Silver	1.16 U	1.16 U	1.16 U	1.16 U	NA	1.16 U	1.16 U	1.16 U	1.16 U	1.16 U	NA	1.16 U
Wet Chemistry (mg/L)												
Chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.83	NA
Nitrate	0.05 U	1.6 J	0.86	0.05 U	NA	0.42 J	0.05 U	0.05 U	0.1	0.05 U	0.05 U	0.05 U
Nitrite	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.05	NA
Sulfate	6.9	58	36	27	NA	57	11	11	120	25	38.7	29
Sulfide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1 U	NA
Total organic carbon (TOC)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.34	NA

NA - Not analyzed
U - Analyte not detected
J - Reported value is estimated
UJ - Not detected, quantitation limit may be inaccurate
R - Unreliable Result

Table G-3
Upper Surficial Aquifer Groundwater Raw Analytical Data
MCAS Cherry Point, North Carolina

Station Identification	OU14-72GW28			OU14-72GW38	OU14-90GW01	OU14-90GW02	OU14-90GW03	OU14-90GW04	OU14-90GW05	OU14-90GW06	OU14-90GW07	OU14-90GW08	
Sample Identification	OU14-72GW28-03D	OU14-72GW28-05B	OU14-72GW28P-05B	OU14-72GW38-03D	OU14-90GW01-05B	OU14-90GW02-05B	OU14-90GW03-05B	OU14-90GW04-05B	OU14-90GW05-05B	OU14-90GW06-05B	OU14-90GW07-05B	OU14-90GW08-05B	OU14-90GW08P-05B
Sample Date	10/22/03	04/21/05	04/21/05	10/27/03	04/19/05	04/19/05	04/20/05	04/19/05	04/18/05	04/18/05	04/18/05	04/18/05	04/18/05
Volatile Organic Compounds (µg/L)													
1,1,1-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	3 J	2.3 J	2.2 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethylene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1.1 J	5 U	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromo-3-chloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromoethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethylene (total)	10 U	NA	NA	10 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,3-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,4-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	5 U	13 U	13 U	25 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U
2-Hexanone	5 U	13 U	13 U	25 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U
4-Methyl-2-pentanone	5 U	13 U	13 U	25 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U
Acetone	5 R	5 J	6.5 J	25 R	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	14 U
Benzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	21	5 U	26	5 U	5 U	5 U
Bromodichloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromoform	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromomethane	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 U	5 R	5 R	5 UJ	5 UJ	5 R	5 R
Carbon disulfide	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1.2 J	5 U	5 U	5 U	5 U	5 U
Carbon tetrachloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 U	5 U	5 U	5 UJ	5 UJ	5 U	5 U
Cumene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2.4 J	5 U	5 U	5 U	5 U	5 U
Cyclohexane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane (Freon-12)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	8.6	5 U	5 U	5 U	5 U	5 U
Methyl acetate	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl-tert-butyl ether (MTBE)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	33 J	5 U	1.8 J	5 U	5 U	5 U
Methylcyclohexane	5 U	5 U	5 U	5 U	5 U	5 U	3.9 J	1.5 J	5 U	5 U	5 U	5 U	5 U
Methylene chloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Styrene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethylene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	5 U	5 U	5 U	5 U	30	5 U	5 U	4.7 J	5 U	5 U	5 U	5 U	5 U
Trichloroethylene	5 U	5 U	5 U	5 U	5 U	2.3 J	5 U	37 J	1.7 J	8.5 J	5 U	5 U	5 U
Trichlorofluoromethane(Freon-11)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl chloride	5 U	2 U	2 U	5 U	2 U	2 U	5 U	2 U	2 U	2 U	2 U	2 U	2 U
Xylene, total	15 U	0.17 J	5 U	15 U	5 U	5 U	5 U	23	5 U	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethylene	5 U	5 U	5 U	5 U	5 U	9.4	9.4	11	5 U	5 U	5 U	5 U	5 U
cis-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
m- and p-Xylene	10 U	NA	NA	10 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
o-Xylene	5 U	NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
trans-1,2-Dichloroethylene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dissolved Gases (mg/L)													
Methane	NA	NA	NA	NA	0.052	1.00E-03 U	NA	NA	NA	1.00E-03 U	1.00E-03 U	NA	NA
Ethane	NA	NA	NA	NA	6.00E-04 J	0.002 U	NA	NA	NA	0.002 U	0.002 U	NA	NA
Ethene	NA	NA	NA	NA	7.00E-05 J	0.002 U	NA	NA	NA	0.002 U	0.002 U	NA	NA
Total Metals (µg/L)													
Arsenic	2.13 U	NA	NA	2.13 U	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table G-3
Upper Surficial Aquifer Groundwater Raw Analytical Data
MCAS Cherry Point, North Carolina

Station Identification	OU14-72GW28			OU14-72GW38	OU14-90GW01	OU14-90GW02	OU14-90GW03	OU14-90GW04	OU14-90GW05	OU14-90GW06	OU14-90GW07	OU14-90GW08	
Sample Identification	OU14-72GW28-03D	OU14-72GW28-05B	OU14-72GW28P-05B	OU14-72GW38-03D	OU14-90GW01-05B	OU14-90GW02-05B	OU14-90GW03-05B	OU14-90GW04-05B	OU14-90GW05-05B	OU14-90GW06-05B	OU14-90GW07-05B	OU14-90GW08-05B	OU14-90GW08P-05B
Sample Date	10/22/03	04/21/05	04/21/05	10/27/03	04/19/05	04/19/05	04/20/05	04/19/05	04/18/05	04/18/05	04/18/05	04/18/05	04/18/05
Barium	58.4	NA	NA	41.9	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	0.25 U	NA	NA	0.25 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	1.6 J	NA	NA	0.88 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	58,300	17,800	NA	NA	NA	35,500	4,960	NA	NA
Lead	5.8	NA	NA	1.56 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	4,050	195	NA	NA	NA	80.2	33.7	NA	NA
Mercury	0.04 U	NA	NA	0.05 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	2.32 U	NA	NA	2.3 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	1.16 U	NA	NA	1.16 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry (mg/L)													
Chloride	NA	NA	NA	NA	8.48	6.96	NA	NA	NA	4.33	4.58	NA	NA
Nitrate	1.9 J	NA	NA	0.74	0.835	0.04 J	NA	NA	NA	0.115	0.05 U	NA	NA
Nitrite	NA	NA	NA	NA	0.05 U	0.03 J	NA	NA	NA	0.05 U	0.045 J	NA	NA
Sulfate	260	NA	NA	39	1,630	115	NA	NA	NA	58.7	33.8	NA	NA
Sulfide	NA	NA	NA	NA	1 U	1 U	NA	NA	NA	1 U	1 U	NA	NA
Total organic carbon (TOC)	NA	NA	NA	NA	10	6.68	NA	NA	NA	6.32	5.55	NA	NA

NA - Not analyzed
U - Analyte not detected
J - Reported value is estimated
UJ - Not detected, quantitation limit may be inaccurate
R - Unreliable Result

Table G-4
Lower Surficial Aquifer Groundwater Raw Analytical Data
MCAS Cherry Point, North Carolina

Station Identification	OU1-MW62	OU14-13GW11		OU14-13GW143		OU14-13GW144		OU14-13GW29		OU14-56GW07	OU14-56GW09		
Sample Identification	OU1-MW62-03D	OU14-13GW11-03D	OU14-13GW11-05B	OU14-13GW143-03D	OU14-13GW143-05B	OU14-13GW144-03D	OU14-13GW144-05B	OU14-13GW29-03D	OU14-13GW29-05B	OU14-56GW07-03D	OU14-56GW09P-03D	OU14-56GW09-03D	OU14-56GW09-05B
Sample Date	10/22/03	10/28/03	04/20/05	10/28/03	04/15/05	10/29/03	04/15/05	10/24/03	04/21/05	10/29/03	10/24/03	10/24/03	04/21/05
Volatile Organic Compounds (µg/L)													
1,1,1-Trichloroethane	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	5 J	29	35	17	15	1 J	5 U	100 U	0.8 J	5 U	5 U	5 U	5 U
1,1-Dichloroethylene	5 U	10 U	2.4 J	5 U	1.2 J	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	5 U	10 U	5 U	5 U	4 J	5 U	4.7 J	100 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromo-3-chloropropane	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromoethane	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichlorobenzene	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	0.5 J	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	0.3 J	0.4 J	5 U
1,2-Dichloroethylene (total)	10 U	190	NA	55	NA	10	NA	65 J	NA	10 U	11	11	NA
1,2-Dichloropropane	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
1,3-Dichlorobenzene	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
1,4-Dichlorobenzene	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	5 U	10 R	13 U	5 R	13 U	5 R	13 U	500 U	2.4 J	5 R	25 U	25 U	13 U
2-Hexanone	5 U	10 U	13 U	5 U	13 U	5 U	13 U	500 U	13 U	5 U	25 U	25 U	13 U
4-Methyl-2-pentanone	5 U	10 U	13 U	5 U	13 U	5 U	13 U	500 U	13 U	5 U	25 U	25 U	13 U
Acetone	5 R	10 R	13 U	5 R	13 U	5 R	13 U	500 R	13 U	17 J	25 U	25 U	14 U
Benzene	1 J	4 J	7.6	38	34	16	9.8	2,000	870	13	15	16	2.6 J
Bromodichloromethane	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
Bromoform	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
Bromomethane	5 U	10 U	5 UJ	5 U	5 R	5 U	5 R	100 U	5 U	5 U	5 U	5 U	5 UJ
Carbon disulfide	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
Carbon tetrachloride	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	5 U	10 U	5 UJ	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 UJ
Cumene	2 J	10 U	5 U	5 U	5 U	0.2 J	5 U	18 J	23	25	0.5 J	0.4 J	1.1 J
Cyclohexane	6	10 U	5 U	24	32	2 J	2.3 J	43 J	110	2 J	5 U	5 U	5 U
Dibromochloromethane	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane (Freon-12)	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5 U	10 U	5 U	0.7 J	1.2 J	1 J	5 U	130	130	98	0.2 J	5 U	5 U
Methyl acetate	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
Methyl-tert-butyl ether (MTBE)	5 U	10 U	5 U	2 J	2.9 J	5 U	5 U	170	76	5 U	5 U	5 U	5 U
Methylcyclohexane	5 U	10 U	5 U	2 J	2.4 J	5 U	5 U	100 U	32	3 J	5 U	5 U	5 U
Methylene chloride	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
Styrene	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	0.5 J	5 U	5 U	5 U
Tetrachloroethylene	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
Toluene	5 U	10 U	5 U	5 U	5 U	0.3 J	5 U	54 J	28	24	5 U	5 U	5 U
Trichloroethylene	5 U	3 J	8.1 J	8	11 J	6	10 J	100 U	5 U	5 U	89	98	15 J
Trichlorofluoromethane(Freon-11)	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
Vinyl chloride	5 U	10 U	2 U	5 U	2 U	5 U	2 U	100 U	2.3	5 U	5 U	5 U	2 U
Xylene, total	15 U	30 U	5 U	0.2 J	5 U	1 J	5 U	730	410	200	0.5 J	15 U	5 U
cis-1,2-Dichloroethylene	0.9 J	190	180	55	51	10	12	65 J	98	5 U	11	11	5 U
cis-1,3-Dichloropropene	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
m- and p-Xylene	10 U	20 U	NA	0.2 J	NA	0.7 J	NA	710	NA	89	0.5 J	10 U	NA
o-Xylene	5 U	10 U	NA	5 U	NA	0.5 J	NA	20 J	NA	110	5 U	5 U	NA
trans-1,2-Dichloroethylene	5 U	10 U	2.1 J	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
trans-1,3-Dichloropropene	5 U	10 U	5 U	5 U	5 U	5 U	5 U	100 U	5 U	5 U	5 U	5 U	5 U
Wet Chemistry (mg/L)													
Methane	NA	NA	0.19	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.077
Ethane	NA	NA	0.002 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.002 U

Table G-4
Lower Surficial Aquifer Groundwater Raw Analytical Data
MCAS Cherry Point, North Carolina

Station Identification	OU1-MW62	OU14-13GW11		OU14-13GW143		OU14-13GW144		OU14-13GW29		OU14-56GW07	OU14-56GW09		
Sample Identification	OU1-MW62-03D	OU14-13GW11-03D	OU14-13GW11-05B	OU14-13GW143-03D	OU14-13GW143-05B	OU14-13GW144-03D	OU14-13GW144-05B	OU14-13GW29-03D	OU14-13GW29-05B	OU14-56GW07-03D	OU14-56GW09P-03D	OU14-56GW09-03D	OU14-56GW09-05B
Sample Date	10/22/03	10/28/03	04/20/05	10/28/03	04/15/05	10/29/03	04/15/05	10/24/03	04/21/05	10/29/03	10/24/03	10/24/03	04/21/05
Ethene	NA	NA	4.00E-05 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.002 U
Total Metals (µg/L)													
Arsenic	4.26 U	2.13 U	NA	2.13 U	NA	2.13 U	NA	2.13 U	NA	2.13 U	6.6 J	5.5 J	NA
Barium	124	78	NA	80.4	NA	37.7	NA	38.3	NA	17.8	67.9	66.3	NA
Cadmium	4 J	4.6 J	NA	0.25 U	NA	0.25 U	NA	0.25 U	NA	0.25 U	0.25 U	0.25 U	NA
Chromium	1.9 J	1.3 J	NA	1.2 J	NA	0.88 U	NA	0.88 U	NA	3.4 J	1.7 J	1.3 J	NA
Iron	NA	NA	4,200	NA	NA	NA	NA	NA	NA	NA	NA	NA	10,300
Lead	3.12 U	12.9	NA	1.56 U	NA	1.56 U	NA	1.56 U	NA	1.56 U	1.56 U	1.56 U	NA
Manganese	NA	NA	56	NA	NA	NA	NA	NA	NA	NA	NA	NA	49.8
Mercury	0.04 U	0.06 J	NA	0.04 J	NA	0.04 UJ	NA	0.04 UJ	NA	0.04 UJ	0.04 UJ	0.05 J	NA
Selenium	4.64 U	2.32 UJ	NA	2.5 J	NA	2.32 UJ	NA	2.32 U	NA	2.32 UJ	3.9 J	2.32 U	NA
Silver	1.6 J	1.16 U	NA	1.16 U	NA	1.16 U	NA	1.16 U	NA	1.16 U	1.16 U	1.16 U	NA
Wet Chemistry (mg/L)													
Chloride	NA	NA	9.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	13.2
Nitrate	0.05 U	0.05 U	0.08	0.085	NA	0.05 U	NA	0.05 U	NA	0.05 U	0.05 U	0.05 U	0.02 J
Nitrite	NA	NA	0.19	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.05 U
Sulfate	2,000	20	24.2	15	NA	1.6	NA	1 U	NA	2 U	34	34	23
Sulfide	NA	NA	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	1 U
Total organic carbon (TOC)	NA	NA	4.98 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	9.01

NA - Not analyzed
U - Analyte not detected
J - Reported value is estimated
UJ - Not detected, quantitation limit may be inaccurate
R - Unreliable Result

Table G-4
Lower Surficial Aquifer Groundwater Raw Analytical Data
MCAS Cherry Point, North Carolina

Station Identification	OU14-56GW12	OU14-66GW13		OU14-66GW14	OU14-66GW29		OU14-66GW33	OU14-66GW46			OU14-72GW07		OU14-72GW12
Sample Identification	OU14-56GW12-03D	OU14-66GW13-03D	OU14-66GW13P-03D	OU14-66GW14-03D	OU14-66GW29-03D	OU14-66GW29-05B	OU14-66GW33-03D	OU14-66GW46-03D	OU14-66GW46-05B	OU14-66GW46P-05B	OU14-72GW07-03D	OU14-72GW07P-03D	OU14-72GW12-03D
Sample Date	10/27/03	10/30/03	10/30/03	10/30/03	10/23/03	04/21/05	10/29/03	10/30/03	04/19/05	04/19/05	10/23/03	10/23/03	10/22/03
Volatile Organic Compounds (µg/L)													
1,1,1-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	5 U	5 U	5 U	5 U	4 J	5 U	0.4 J	5 U	5 U	5 U	5 U	0.4 J	2 J
1,1-Dichloroethylene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromo-3-chloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromoethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	0.5 J	0.3 J	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethylene (total)	10 U	10 U	10 U	10 U	6 J	NA	9 J	3 J	NA	NA	10 U	10 U	10 U
1,2-Dichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,3-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,4-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	25 U	5 R	5 R	5 R	5 R	13 U	5 R	5 R	13 U	13 U	5 R	5 R	5 U
2-Hexanone	25 U	5 U	5 U	5 U	5 U	13 U	5 U	5 U	13 U	13 U	5 U	3 J	5 U
4-Methyl-2-pentanone	25 U	5 U	5 U	5 U	5 U	13 U	5 U	5 U	13 U	13 U	5 U	5 U	5 U
Acetone	25 U	5 R	5 R	5 R	5 R	2.9 J	5 R	5 R	24 U	28 U	5 R	5 R	5 R
Benzene	0.2 J	5 U	5 U	28	4 J	5 U	2 J	0.8 J	5 U	5 U	64	66	5 U
Bromodichloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromoform	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromomethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 R	1.6 J	5 U	5 U	5 U
Carbon disulfide	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1.3 J	5 U	5 U	5 U
Carbon tetrachloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	6.4 U	8.4 U	5 U	5 U	5 U
Cumene	5 U	5 U	5 U	5 U	0.3 J	5 U	5 U	5 U	5 U	5 U	3 J	3 J	5 U
Cyclohexane	5 U	5 U	5 U	5 U	37	5 U	3 J	5 U	5 U	5 U	61	64	5
Dibromochloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane (Freon-12)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	0.1 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl acetate	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl-tert-butyl ether (MTBE)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methylcyclohexane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	11	12	5 U
Methylene chloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Styrene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethylene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	5 U	5 U	5 U	5 U	0.5 J	5 U	5 U	5 U	5 U	5 U	2 J	2 J	5 U
Trichloroethylene	5 U	5 U	5 U	5 U	5	1.2 J	5 U	1 J	1.4 J	5 U	5 U	5 U	5 U
Trichlorofluoromethane(Freon-11)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl chloride	5 U	5 U	5 U	5 U	5 U	2 U	5 U	5 U	2 U	2 U	5 U	5 U	5 U
Xylene, total	15 U	15 U	15 U	15 U	15 U	5 U	15 U	15 U	5 U	5 U	4 J	4 J	15 U
cis-1,2-Dichloroethylene	5 U	5 U	5 U	5 U	6	5 U	9	3 J	5 U	5 U	5 U	5 U	1 J
cis-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
m- and p-Xylene	0.2 J	10 U	10 U	10 U	10 U	NA	10 U	10 U	NA	NA	3 J	3 J	10 U
o-Xylene	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	NA	NA	0.8 J	0.8 J	5 U
trans-1,2-Dichloroethylene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Wet Chemistry (mg/L)													
Methane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Station Identification	OU14-56GW12	OU14-66GW13		OU14-66GW14	OU14-66GW29		OU14-66GW33	OU14-66GW46			OU14-72GW07		OU14-72GW12
Sample Identification	OU14-56GW12-03D	OU14-66GW13-03D	OU14-66GW13P-03D	OU14-66GW14-03D	OU14-66GW29-03D	OU14-66GW29-05B	OU14-66GW33-03D	OU14-66GW46-03D	OU14-66GW46-05B	OU14-66GW46P-05B	OU14-72GW07-03D	OU14-72GW07P-03D	OU14-72GW12-03D
Sample Date	10/27/03	10/30/03	10/30/03	10/30/03	10/23/03	04/21/05	10/29/03	10/30/03	04/19/05	04/19/05	10/23/03	10/23/03	10/22/03
Ethene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (µg/L)													
Arsenic	2.13 U	2.13 U	2.13 U	2.13 U	2.13 U	NA	2.13 U	2.13 U	NA	NA	2.13 U	2.13 U	2.13 U
Barium	59.5	80.7	84	18.3	58.4	NA	140	72.4	NA	NA	52.6	53	133
Cadmium	0.25 U	0.25 U	0.27 J	0.25 U	0.25 U	NA	0.25 U	0.25 U	NA	NA	0.25 U	0.25 U	2 J
Chromium	0.88 U	0.88 U	1.1 J	1.7 J	0.92 J	NA	5.1 J	1.8 J	NA	NA	0.88 U	0.88 U	2.8 J
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	1.56 U	1.56 U	1.56 U	1.56 U	1.56 U	NA	1.56 U	1.56 U	NA	NA	1.56 U	1.56 U	6.2
Manganese	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	0.04 UJ	0.04 U	0.04 U	0.04 U	0.06 J	NA	0.05 J	0.04 U	NA	NA	0.04 U	0.04 U	0.04 U
Selenium	3 J	2.32 U	2.32 U	4 J	2.32 U	NA	3.2 J	2.32 U	NA	NA	2.32 U	2.32 U	3.7 J
Silver	1.16 U	1.16 U	1.16 U	1.16 U	1.16 U	NA	1.16 U	1.16 U	NA	NA	1.16 U	1.16 U	1.16 U
Wet Chemistry (mg/L)													
Chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate	0.05 U	0.59	0.44	0.1	0.05 U	NA	0.05 U	0.05 U	NA	NA	0.05 U	0.05 U	0.05 U
Nitrite	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	25	19	19	35	32	NA	96	79	NA	NA	1 U	1 U	1,000
Sulfide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA - Not analyzed
U - Analyte not detected
J - Reported value is estimated
UJ - Not detected, quantitation limit may be inaccurate
R - Unreliable Result

Table G-4
Lower Surficial Aquifer Groundwater Raw Analytical Data
MCAS Cherry Point, North Carolina

Station Identification	OU14-72GW19		OU14-72GW20	OU14-72GW24	OU14-72GW25	OU14-72GW27			OU14-72GW29	OU14-72GW41	OU14-72GW43	OU14-90GW09	OU14-90GW10
Sample Identification	OU14-72GW19-03D	OU14-72GW19-05B	OU14-72GW20-03D	OU14-72GW24-03D	OU14-72GW25-03D	OU14-72GW27-03D	OU14-72GW27-05B	OU14-72GW27P-05B	OU14-72GW29-03D	OU14-72GW41-03D	OU14-72GW43-03D	OU14-90GW09-05B	OU14-90GW10-05B
Sample Date	10/31/03	04/20/05	10/24/03	10/23/03	10/23/03	10/23/03	04/21/05	04/21/05	10/22/03	10/27/03	10/27/03	04/20/05	04/20/05
Volatile Organic Compounds (µg/L)													
1,1,1-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	0.9 J	5 U	2 J	0.2 J	2 J	130	63	66	0.5 J	5 U	5 U	5 U	5 U
1,1-Dichloroethylene	0.6 J	5 U	0.4 J	5 U	5 U	5 U	1.3 J	0.93 J	5 U	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromo-3-chloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromoethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	21
1,2-Dichloroethylene (total)	140	NA	10 U	23	2 J	19	NA	NA	10 U	10 U	10 U	NA	NA
1,2-Dichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,3-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,4-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	5 R	13 U	25 U	5 R	5 R	5 R	13 U	13 U	5 U	25 U	25 U	13 U	13 U
2-Hexanone	5 U	13 U	25 U	5 U	5 U	5 U	13 U	13 U	5 U	25 U	25 U	13 U	13 U
4-Methyl-2-pentanone	5 U	13 U	25 U	5 U	5 U	5 U	13 U	13 U	5 U	25 U	25 U	13 U	13 U
Acetone	5 R	13 U	25 U	5 R	5 R	5 R	13 U	13 U	5 R	25 U	25 U	13 U	13 U
Benzene	0.8 J	1.4 J	5 U	0.5 J	5 U	4 J	2.1 J	1.9 J	6	5 U	5 U	5 U	5 U
Bromodichloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromoform	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromomethane	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 U
Carbon disulfide	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon tetrachloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	23 U	5 U
Chloromethane	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 U
Cumene	5 U	5 U	5 U	5 U	5 U	0.5 J	5 U	0.23 J	85	5 U	5 U	5 U	5 U
Cyclohexane	5 U	5 U	5 U	5 U	5	11	5.2	4.8 J	8	5 U	5 U	5 U	5 U
Dibromochloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane (Freon-12)	5 U	5 U	5 U	5 U	5 U	6	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5 U	5 U	0.1 J	5 U	5 U	5 U	5 U	5 U	1 J	5 U	5 U	5 U	5 U
Methyl acetate	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl-tert-butyl ether (MTBE)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	0.38 J	5 U	5 U	0.4 J	5 U	5 U
Methylcyclohexane	5 U	5 U	5 U	5 U	5 U	7	5.4	4.7 J	2 J	5 U	5 U	5 U	5 U
Methylene chloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Styrene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethylene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	5 U	5 U	5 U	5 U	5 U	0.2 J	5 U	5 U	0.2 J	5 U	5 U	5 U	0.14 J
Trichloroethylene	22	19 J	5 U	5 U	5 U	5 J	4 J	3 J	1 J	5 U	5 U	5 U	5 U
Trichlorofluoromethane(Freon-11)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl chloride	5 U	2 U	5 U	5 U	5 U	2 J	2 U	2 U	5 U	5 U	5 U	2 U	5 U
Xylene, total	15 U	5 U	15 U	15 U	15 U	0.4 J	5 U	5 U	15 U	15 U	15 U	5 U	0.19 J
cis-1,2-Dichloroethylene	110	92	5 U	23	2 J	19	12	9.9	1 J	5 U	5 U	5 U	5 U
cis-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
m- and p-Xylene	10 U	NA	0.2 J	10 U	10 U	0.4 J	NA	NA	10 U	10 U	10 U	NA	NA
o-Xylene	5 U	NA	5 U	5 U	5 U	5 U	NA	NA	5 U	5 U	5 U	NA	NA
trans-1,2-Dichloroethylene	23	25	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Wet Chemistry (mg/L)													
Methane	NA	0.051	NA	NA	NA	NA	0.21	NA	NA	NA	NA	0.051	NA
Ethane	NA	0.002 U	NA	NA	NA	NA	3.00E-04 J	NA	NA	NA	NA	0.002 U	NA

Station Identification	OU14-72GW19		OU14-72GW20	OU14-72GW24	OU14-72GW25	OU14-72GW27			OU14-72GW29	OU14-72GW41	OU14-72GW43	OU14-90GW09	OU14-90GW10
Sample Identification	OU14-72GW19-03D	OU14-72GW19-05B	OU14-72GW20-03D	OU14-72GW24-03D	OU14-72GW25-03D	OU14-72GW27-03D	OU14-72GW27-05B	OU14-72GW27P-05B	OU14-72GW29-03D	OU14-72GW41-03D	OU14-72GW43-03D	OU14-90GW09-05B	OU14-90GW10-05B
Sample Date	10/31/03	04/20/05	10/24/03	10/23/03	10/23/03	10/23/03	04/21/05	04/21/05	10/22/03	10/27/03	10/27/03	04/20/05	04/20/05
Ethene	NA	7.00E-05 J	NA	NA	NA	NA	0.002 U	NA	NA	NA	NA	4.00E-05 J	NA
Total Metals (µg/L)													
Arsenic	2.13 U	NA	2.13 U	2.8 J	2.13 U	2.13 U	NA	NA	2.13 U	2.13 U	2.5 J	NA	NA
Barium	111	NA	57.9	47.9	38.8	65.6	NA	NA	62.5	40.1	53.8	NA	NA
Cadmium	0.25 U	NA	0.25 U	0.25 U	0.25 U	0.25 U	NA	NA	0.53 J	0.25 U	0.25 U	NA	NA
Chromium	2 J	NA	0.88 U	0.88 U	0.88 U	1.3 J	NA	NA	2.1 J	0.88 U	0.88 U	NA	NA
Iron	NA	1,720	NA	NA	NA	NA	1,930	NA	NA	NA	NA	7,910	NA
Lead	4 J	NA	1.56 U	1.7 U	2.5 U	2.2 U	NA	NA	8.6	1.56 U	1.6 J	NA	NA
Manganese	NA	169	NA	NA	NA	NA	35.7	NA	NA	NA	NA	134	NA
Mercury	0.07 J	NA	0.04 UJ	0.04 U	0.04 U	0.04 U	NA	NA	0.04 U	0.04 UJ	0.04 UJ	NA	NA
Selenium	2.32 U	NA	2.32 U	2.32 U	2.32 U	2.32 U	NA	NA	2.7 J	2.32 U	2.32 U	NA	NA
Silver	1.16 U	NA	1.16 U	1.16 U	1.16 U	1.16 U	NA	NA	1.16 U	1.16 U	1.16 U	NA	NA
Wet Chemistry (mg/L)													
Chloride	NA	7	NA	NA	NA	NA	8.64	NA	NA	NA	NA	10.1	NA
Nitrate	0.05 U	0.04 J	0.05 U	0.42 J	0.05 U	0.05 U	0.015 J	NA	0.05 U	0.097	0.05 U	0.05 U	NA
Nitrite	NA	0.05 U	NA	NA	NA	NA	0.05 U	NA	NA	NA	NA	0.03 J	NA
Sulfate	12	122	14	14	14	51	75.2	NA	27	8.4	28	11.2	NA
Sulfide	NA	1 U	NA	NA	NA	NA	1 U	NA	NA	NA	NA	1 U	NA
Total organic carbon (TOC)	NA	4.65 J	NA	NA	NA	NA	8.88	NA	NA	NA	NA	9.58	NA

NA - Not analyzed
U - Analyte not detected
J - Reported value is estimated
UJ - Not detected, quantitation limit may be inaccurate
R - Unreliable Result

Station Identification	OU14-90GW11	OU14-90GW12	OU14-90GW13	OU14-90GW14	OU14-90GW15	OU14-90GW16
Sample Identification	OU14-90GW11-05B	OU14-90GW12-05B	OU14-90GW13-05B	OU14-90GW14-05B	OU14-90GW15-05B	OU14-90GW16-05B
Sample Date	04/21/05	04/20/05	04/20/05	04/15/05	04/18/05	04/18/05
Volatile Organic Compounds (µg/L)						
1,1,1-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethylene	5 U	5 U	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromo-3-chloropropane	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromoethane	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethylene (total)	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	5 U	5 U	5 U	5 U	5 U	5 U
1,3-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U
1,4-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	13 U	13 U	13 U	13 U	13 U	13 U
2-Hexanone	13 U	13 U	13 U	13 U	13 U	13 U
4-Methyl-2-pentanone	13 U	13 U	13 U	13 U	13 U	13 U
Acetone	13 U	18 U	13 U	13 U	13 U	13 U
Benzene	5 U	5 U	5 U	5 U	5 U	5 U
Bromodichloromethane	5 U	5 U	5 U	5 U	5 U	5 U
Bromoform	5 U	5 U	5 U	5 U	5 U	5 U
Bromomethane	5 U	5 UJ	5 UJ	5 R	5 R	5 UJ
Carbon disulfide	5 U	5 U	5 U	5 U	5 U	5 U
Carbon tetrachloride	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	5 U	5 UJ	5 UJ	5 U	5 U	5 UJ
Cumene	5 U	5 U	5 U	5 U	5 U	5 U
Cyclohexane	5 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	5 U	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane (Freon-12)	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5 U	5 U	5 U	5 U	5 U	5 U
Methyl acetate	5 U	5 U	5 U	5 U	5 U	5 U
Methyl-tert-butyl ether (MTBE)	5 U	5 U	5 U	5 U	5 U	5 U
Methylcyclohexane	5 U	5 U	5 U	5 U	5 U	5 U
Methylene chloride	5 U	5 U	5 U	5 U	5 U	5 U
Styrene	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethylene	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethylene	5 U	5 U	5 U	5 U	1.8 J	5 U
Trichlorofluoromethane(Freon-11)	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl chloride	2 U	2 U	2 U	2 U	2 U	2 U
Xylene, total	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethylene	5 U	5 U	5 U	3 J	5 U	2.3 J
cis-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U
m- and p-Xylene	NA	NA	NA	NA	NA	NA
o-Xylene	NA	NA	NA	NA	NA	NA
trans-1,2-Dichloroethylene	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U
Wet Chemistry (mg/L)						
Methane	NA	0.028	0.09	NA	NA	0.043
Ethane	NA	0.002 U	0.002 U	NA	NA	0.002 U

Station Identification	OU14-90GW11	OU14-90GW12	OU14-90GW13	OU14-90GW14	OU14-90GW15	OU14-90GW16
Sample Identification	OU14-90GW11-05B	OU14-90GW12-05B	OU14-90GW13-05B	OU14-90GW14-05B	OU14-90GW15-05B	OU14-90GW16-05B
Sample Date	04/21/05	04/20/05	04/20/05	04/15/05	04/18/05	04/18/05
Ethene	NA	3.00E-04 J	0.002 U	NA	NA	7.00E-05 J
Total Metals (µg/L)						
Arsenic	NA	NA	NA	NA	NA	NA
Barium	NA	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA	NA
Iron	NA	7,200	734	NA	NA	5,430
Lead	NA	NA	NA	NA	NA	NA
Manganese	NA	513	11.2	NA	NA	143
Mercury	NA	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA	NA
Silver	NA	NA	NA	NA	NA	NA
Wet Chemistry (mg/L)						
Chloride	NA	14.3	10.5	NA	NA	8.96
Nitrate	NA	0.05 U	0.445	NA	NA	0.055
Nitrite	NA	0.05 U	0.05 U	NA	NA	0.05 U
Sulfate	NA	243	5.28	NA	NA	93.5
Sulfide	NA	2 U	1 U	NA	NA	1 U
Total organic carbon (TOC)	NA	25.9	4.68 J	NA	NA	9.28

NA - Not analyzed
U - Analyte not detected
J - Reported value is estimated
UJ - Not detected, quantitation limit may be inaccurate
R - Unreliable Result

Table G-5
Yorktown Aquifer Groundwater Raw Analytical Data
MCAS Cherry Point, North Carolina

Station Identification	OU14-90GW17				OU14-90GW18
Sample Identification	OU14-90GW17-05B	OU14-90GW17P-05B	OU14-90GW17-0807	OU14-90GW17P-0807	OU14-90GW18-05B
Sample Date	04/20/05	04/20/05	08/29/07	08/29/07	04/20/05
Volatile Organic Compounds (µg/L)					
1,1,1-Trichloroethane	5 U	5 U	0.5 U	0.5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	5 U	0.5 U	0.5 U	5 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	5 U	5 U	0.5 U	0.5 U	5 U
1,1,2-Trichloroethane	5 U	5 U	0.5 U	0.5 U	5 U
1,1-Dichloroethane	5 U	5 U	0.5 U	0.5 U	5 U
1,1-Dichloroethylene	5 U	5 U	0.5 U	0.5 U	5 U
1,2,4-Trichlorobenzene	5 U	5 U	0.5 U	0.5 U	5 U
1,2-Dibromo-3-chloropropane	5 U	5 U	0.5 U	0.5 U	5 U
1,2-Dibromoethane	5 U	5 U	0.5 U	0.5 U	5 U
1,2-Dichlorobenzene	5 U	5 U	0.5 U	0.5 U	5 U
1,2-Dichloroethane	5 U	5 U	0.5 U	0.5 U	5 U
1,2-Dichloropropane	5 U	5 U	0.5 U	0.5 U	5 U
1,3-Dichlorobenzene	5 U	5 U	0.5 U	0.5 U	5 U
1,4-Dichlorobenzene	5 U	5 U	0.5 U	0.5 U	5 U
2-Butanone	13 U	13 U	5 U	5 U	13 U
2-Hexanone	13 U	13 U	5 U	5 U	13 U
4-Methyl-2-pentanone	13 U	13 U	5 U	5 U	13 U
Acetone	3.5 J	3.7 J	5 U	5 U	13 U
Benzene	5 U	0.19 J	0.5 U	0.5 U	5 U
Bromodichloromethane	2.9 J	2.8 J	0.5 U	0.5 U	5 U
Bromoform	5 U	5 U	0.5 U	0.5 U	5 U
Bromomethane	5 U	5 U	0.5 U	0.5 U	5 U
Carbon disulfide	1.8 J	5 U	0.5 U	0.5 U	3.1 J
Carbon tetrachloride	5 U	5 U	0.5 U	0.5 U	5 U
Chlorobenzene	5 U	5 U	0.5 U	0.5 U	5 U
Chloroethane	5 U	5 U	0.5 U	0.5 U	5 U
Chloroform	64 U	63 U	0.5 U	0.5 U	5.4 U
Chloromethane	5 U	5 U	0.5 U	0.5 U	5 U
Cumene (isopropylbenzene)	0.3 J	0.3 J	0.5 U	0.5 U	5 U
Cyclohexane	5 U	5 U	0.5 U	0.5 U	5 U
Dibromochloromethane	5 U	5 U	0.5 U	0.5 U	5 U
Dichlorodifluoromethane (Freon-12)	5 U	5 U	0.5 U	0.5 U	5 U
Ethylbenzene	1 J	1 J	0.5 U	0.5 U	0.13 J
Methyl acetate	5 U	5 U	0.5 U	0.5 U	5 U
Methyl-tert-butyl ether (MTBE)	5 U	5 U	0.5 U	0.5 U	5 U
Methylcyclohexane	5 U	5 U	0.5 U	0.5 U	5 U
Methylene chloride	5 U	5 U	0.5 U	0.5 U	5 U
Styrene	5 U	5 U	0.5 U	0.5 U	5 U
Tetrachloroethylene	5 U	0.31 J	0.5 U	0.5 U	5 U
Toluene	0.32 J	0.28 J	0.5 U	0.5 U	0.19 J
Trichloroethylene	5 U	5 U	0.5 U	0.5 U	5 U
Trichlorofluoromethane(Freon-11)	5 U	5 U	0.5 U	0.5 U	5 U
Vinyl chloride	5 U	5 U	0.5 U	0.5 U	5 U
Xylene, total	2.8 J	2.9 J	0.5 U	0.5 U	0.53 J
cis-1,2-Dichloroethylene	5 U	5 U	0.5 U	0.5 U	5 U
cis-1,3-Dichloropropene	5 U	5 U	0.5 U	0.5 U	5 U
m- and p-Xylene	NA	NA	0.5 U	0.5 U	NA
o-Xylene	NA	NA	0.5 U	0.5 U	NA
trans-1,2-Dichloroethylene	5 U	5 U	0.5 U	0.5 U	5 U
trans-1,3-Dichloropropene	5 U	5 U	0.5 U	0.5 U	5 U
Wet Chemistry (mg/L)					
Methane	NA	NA	NA	NA	NA
Ethane	NA	NA	NA	NA	NA
Ethene	NA	NA	NA	NA	NA
Total Metals (µg/L)					
Arsenic	NA	NA	NA	NA	NA
Barium	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA
Silver	NA	NA	NA	NA	NA
Wet Chemistry (mg/L)					
Chloride	NA	NA	NA	NA	NA
Nitrate	NA	NA	NA	NA	NA
Nitrite	NA	NA	NA	NA	NA
Sulfate	NA	NA	NA	NA	NA
Sulfide	NA	NA	NA	NA	NA
Total organic carbon (TOC)	NA	NA	NA	NA	NA

NA - Not analyzed
U - Analyte not detected
J - Reported value is estimated
UJ - Not detected, quantitation limit may be inaccurate
R - Unreliable Result

Table G-6
Surface Water Raw Analytical Data
MCAS Cherry Point, North Carolina

Station Identification	OU14-SD01/SW01	OU14-SD02/SW02	OU14-SD03/SW03	OU14-SD04/SW04	OU14-SD05/SW05	OU14-SW06	
Sample Identification	OU14-SW01-0406	OU14-SW02-0406	OU14-SW03-0406	OU14-SW04-0406	OU14-SW05-0406	OU14-SW06-0406	OU14-SW06D-0406
Sample Date	04/25/06	04/25/06	04/25/06	04/25/06	04/25/06	04/25/06	04/25/06
Chemical Name							
Volatile Organic Compounds (µg/L)							
1,1,1-Trichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2,2-Tetrachloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethylene	0.5 U	0.5 U	0.5 U	0.12 J	0.5 U	0.5 U	0.5 U
1,2,3-Trichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,4-Trichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dibromo-3-chloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dibromoethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,3-Dichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,4-Dichlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Butanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	5 U	6 U	5.3 U	6 U	5.6 U	5 U	6.1 U
Benzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.16 J
Bromochloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromodichloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromoform	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.1 J	0.5 U
Bromomethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Carbon disulfide	0.5 U	0.5 U	0.12 J	0.5 U	0.5 U	0.5 U	0.5 U
Carbon tetrachloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroform	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Cyclohexane	0.5 U	0.5 U	0.5 U	0.1 J	0.5 U	0.3 J	0.28 J
Dibromochloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dichlorodifluoromethane (Freon-12)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methyl acetate	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methyl-tert-butyl ether (MTBE)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methylcyclohexane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methylene chloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Styrene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Tetrachloroethylene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Table G-6
Surface Water Raw Analytical Data
MCAS Cherry Point, North Carolina

Station Identification	OU14-SD01/SW01	OU14-SD02/SW02	OU14-SD03/SW03	OU14-SD04/SW04	OU14-SD05/SW05	OU14-SW06	
Sample Identification	OU14-SW01-0406	OU14-SW02-0406	OU14-SW03-0406	OU14-SW04-0406	OU14-SW05-0406	OU14-SW06-0406	OU14-SW06D-0406
Sample Date	04/25/06	04/25/06	04/25/06	04/25/06	04/25/06	04/25/06	04/25/06
Chemical Name							
Volatile Organic Compounds (µg/L)							
Toluene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethylene	0.5 U	0.5 U	0.5 U	0.12 J	0.5 U	0.19 J	0.18 J
Trichlorofluoromethane(Freon-11)	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl chloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Xylene, total	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
cis-1,2-Dichloroethylene	0.5 U	0.15 J	0.25 J	0.39 J	0.5 U	0.48 J	0.5
cis-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
isopropylbenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
trans-1,2-Dichloroethylene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
trans-1,3-Dichloropropene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Total Metals (µg/L)							
Arsenic	1.6 U	2.4 J	2.9 J	3.5 J	1.6 U	1.8 J	5.5 J
Barium	31 J	34.8 J	34.4 J	36.8 J	10.6 J	35.3 J	38.2 J
Cadmium	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chromium	0.71 U	1.1 U	0.81 U	0.76 U	0.81 U	0.6 U	0.98 U
Lead	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Mercury	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Selenium	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U
Silver	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dissolved Metals (µg/L)							
Arsenic	2.8 U	2.8 U	3.7 U	3.3 U	2 U	3.2 U	3.7 U
Barium	30 J	30.8 J	31.2 J	32.4 J	8.2 J	31.7 J	31.8 J
Cadmium	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chromium	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U
Lead	1 U	1.1 J	1 U	1 U	1 U	1 U	1 U
Mercury	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Selenium	2 J	2.1 J	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U
Silver	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Wet Chemistry (mg/L)							
Hardness	118	117	120	107	92.6	124	131

U- Analyte not detected
J- Reported value is estimated
UJ- Analyte not detected. Quantitation limit is imprecise

Table G-7
Sediment Raw Analytical Data
MCAS Cherry Point, North Carolina

Station Identification	OU14-SD01/SW01	OU14-SD02/SW02	OU14-SD03/SW03	OU14-SD04/SW04	OU14-SD05/SW05	OU14-SD06	
Sample Identification	OU14-SD01-0406	OU14-SD02-0406	OU14-SD03-0406	OU14-SD04-0406	OU14-SD05-0406	OU14-SD06-0406	OU14-SD06D-0406
Sample Date	04/25/06	04/25/06	04/25/06	04/25/06	04/25/06	04/25/06	04/25/06
Volatile Organic Compounds (µg/kg)							
1,1,1-Trichloroethane	14 U	13 U	15 U	13 U	12 U	12 U	12 U
1,1,2,2-Tetrachloroethane	14 U	13 U	15 U	13 U	12 U	12 U	12 U
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	14 U	13 U	15 U	13 U	12 U	12 U	12 U
1,1,2-Trichloroethane	14 U	13 U	15 U	13 U	12 U	12 U	12 U
1,1-Dichloroethane	14 U	13 U	15 U	13 U	12 U	12 U	12 U
1,1-Dichloroethylene	14 U	13 U	15 U	13 U	12 U	12 U	12 U
1,2,4-Trichlorobenzene	14 U	13 U	15 U	13 U	12 U	12 U	12 U
1,2-Dibromo-3-chloropropane	14 U	13 U	15 U	13 U	12 U	12 U	12 U
1,2-Dibromoethane	14 U	13 U	15 U	13 U	12 U	12 U	12 U
1,2-Dichlorobenzene	14 U	13 U	15 U	13 U	12 U	12 U	12 U
1,2-Dichloroethane	14 U	13 U	15 U	13 U	12 U	12 U	12 U
1,2-Dichloropropane	14 U	13 U	15 U	13 U	12 U	12 U	12 U
1,3-Dichlorobenzene	14 U	13 U	15 U	13 U	12 U	12 U	12 U
1,4-Dichlorobenzene	14 U	13 U	15 U	13 U	12 U	12 U	12 U
2-Butanone	14 U	13 U	15 U	13 U	12 U	12 U	12 U
2-Hexanone	14 U	13 U	15 U	13 U	12 U	12 U	12 U
4-Methyl-2-pentanone	14 U	13 U	15 U	13 U	12 U	12 U	12 U
Acetone	14 U	13 U	15 U	13 U	12 U	12 U	12 U
Benzene	14 U	13 U	15 U	13 U	12 U	12 U	12 U
Bromodichloromethane	14 U	13 U	15 U	13 U	12 U	12 U	12 U
Bromoform	14 U	13 U	15 U	13 U	12 U	12 U	12 U
Bromomethane	14 U	13 U	15 U	13 U	12 U	12 U	12 U
Carbon disulfide	14 U	13 U	15 U	13 U	12 U	12 U	12 U
Carbon tetrachloride	14 U	13 U	15 U	13 U	12 U	12 U	12 U
Chlorobenzene	14 U	13 U	15 U	13 U	12 U	12 U	12 U
Chloroethane	14 U	13 U	15 U	13 U	12 U	12 U	12 U
Chloroform	14 U	13 U	15 U	13 U	12 U	12 U	12 U
Chloromethane	14 U	13 U	15 U	13 U	12 U	12 U	12 U
Cyclohexane	14 U	13 U	15 U	13 U	12 U	12 U	12 U
Dibromochloromethane	14 U	13 U	15 U	13 U	12 U	12 U	12 U
Dichlorodifluoromethane (Freon-12)	14 U	13 U	15 U	13 U	12 U	12 U	12 U
Ethylbenzene	14 U	13 U	15 U	13 U	12 U	12 U	12 U
Methyl acetate	14 U	13 U	15 U	13 U	12 U	12 U	12 U
Methyl-tert-butyl ether (MTBE)	14 U	13 U	15 U	13 U	12 U	12 U	12 U
Methylcyclohexane	14 U	13 U	15 U	13 U	12 U	12 U	12 U
Methylene chloride	14 U	13 U	15 U	13 U	12 U	12 U	12 U
Styrene	14 U	13 U	15 U	13 U	12 U	12 U	12 U
Tetrachloroethylene	14 U	13 U	15 U	13 U	12 U	12 U	12 U

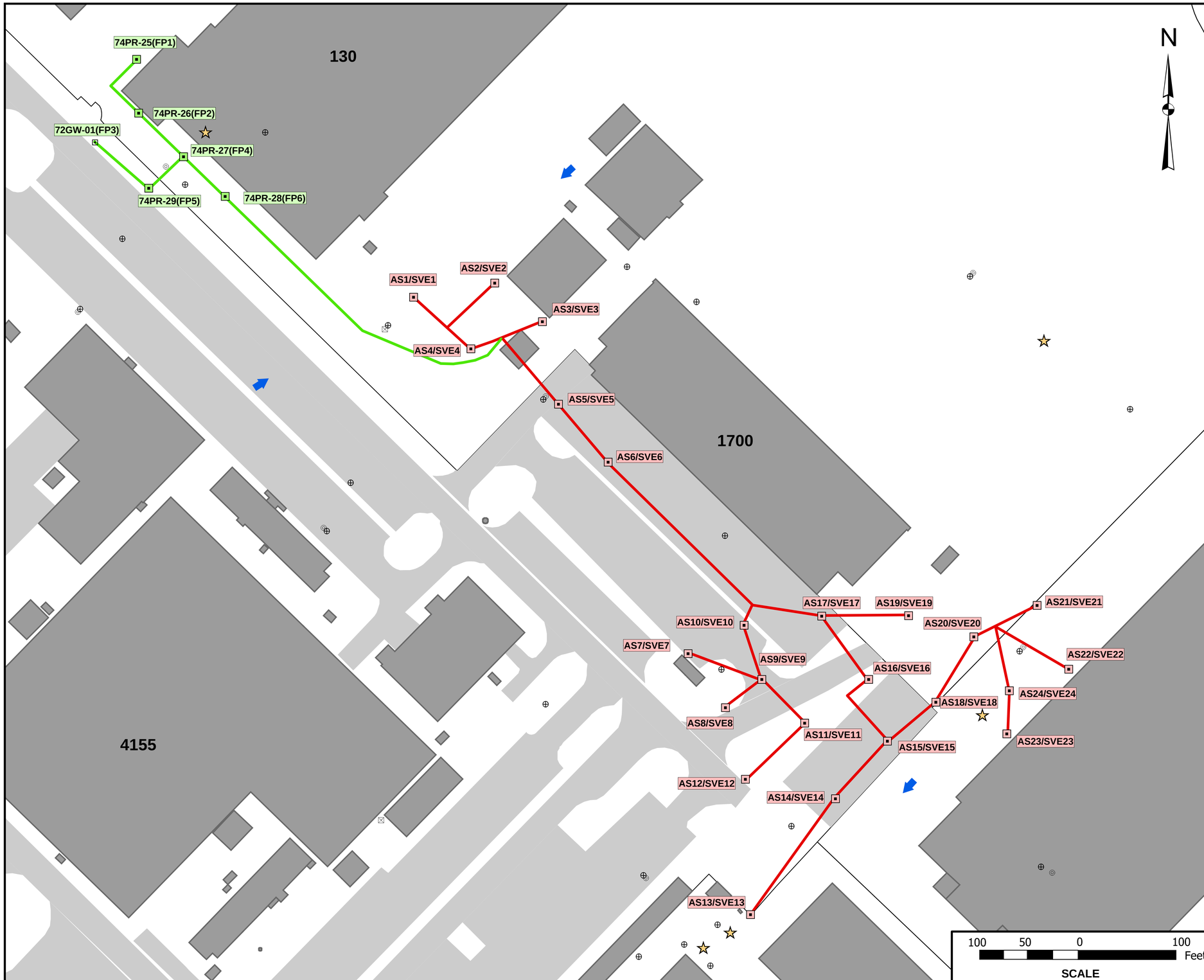
Table G-7
Sediment Raw Analytical Data
MCAS Cherry Point, North Carolina

Station Identification	OU14-SD01/SW01	OU14-SD02/SW02	OU14-SD03/SW03	OU14-SD04/SW04	OU14-SD05/SW05	OU14-SD06	
Sample Identification	OU14-SD01-0406	OU14-SD02-0406	OU14-SD03-0406	OU14-SD04-0406	OU14-SD05-0406	OU14-SD06-0406	OU14-SD06D-0406
Sample Date	04/25/06	04/25/06	04/25/06	04/25/06	04/25/06	04/25/06	04/25/06
Volatile Organic Compounds (µg/kg)							
Toluene	14 U	13 U	15 U	13 U	12 U	12 U	12 U
Trichloroethylene	14 U	13 U	15 U	13 U	12 U	12 U	12 U
Trichlorofluoromethane(Freon-11)	14 U	13 U	15 U	13 U	12 U	12 U	12 U
Vinyl chloride	14 U	13 U	15 U	13 U	12 U	12 U	12 U
Xylene, total	14 U	13 U	15 U	13 U	12 U	12 U	12 U
cis-1,2-Dichloroethylene	14 U	13 U	15 U	13 U	12 U	12 U	12 U
cis-1,3-Dichloropropene	14 U	13 U	15 U	13 U	12 U	12 U	12 U
isopropylbenzene	14 U	13 U	15 U	13 U	12 U	12 U	12 U
trans-1,2-Dichloroethylene	14 U	13 U	15 U	13 U	12 U	12 U	12 U
trans-1,3-Dichloropropene	14 U	13 U	15 U	13 U	12 U	12 U	12 U
Total Metals (mg/kg)							
Arsenic	1.3	2	2.5	1.7	0.18 U	0.27 J	0.22 J
Barium	5.7 J	3.6 J	4.8 J	16.3 J	2.9 J	29.9 J	2.5 J
Cadmium	0.08 J	0.06 J	0.05 J	0.03 U	0.02 U	0.02 U	0.02 U
Chromium	2.3	2.4	3	11	13.8	2	1.9
Lead	4	4.5	4.6	6.1	1.9	1.4 J	1.2
Mercury	0.02 U	0.021 U	0.025 U	0.02 U	0.019 U	0.019 U	0.019 U
Selenium	0.23 U	0.23 U	0.27 U	0.23 U	0.21 U	0.23 J	0.21 U
Silver	0.06 U	0.06 U	0.07 U	0.06 U	0.06 U	0.06 U	0.06 U
Wet Chemistry (mg/kg)							
Total organic carbon (TOC)	7,550	5,580	11,200	6,010	1,680	2,940	1,850
pH	7.05	6.59	6.36	6.5	7.64	7.47	7.97

Notes:
U- Analyte not detected
J- Reported value is estimated
Shading represents detection

OU14 RI
Appendix L

UST Program Remediation Systems at OU14



MCAS CHERRY POINT PERIODIC MONITORING REPORT

LEGEND

Well by Type

- Potable Well
- Industrial Well
- RW
- Surface Water
- T-I
- T-II
- T-III
- Unknown

Free Product

- No Measurable Thickness
- Product Detected
- Free Product Plume
- Railroad
- Small Tributaries
- Rivers and Creeks
- Building
- Groundwater Flow Direction
- Known Points of Release

NOTES

1. Existing Remedial System location was adapted from as-built drawings dated May 2001 by J.A.Jones Enviromental Services.

CATLIN ENGINEERS and SCIENTISTS

SITE 130/3996 FREE PRODUCT PLUME MAP

FIGURE **1.1C**

Job No.:	Date:	Scale:	Drawn By:	Checked By:
204-077	NOV 2004	AS SHOWN	THW	JKB

INDEX OF SHEETS

SHEET NO.	DRAWING NO.	SHEET TITLE
SHEET 1 OF 19	C-1	TITLE SHEET WITH SITE LOCATION MAP
SHEET 2 OF 19	C-2	GENERAL NOTES AND LEGENDS
SHEET 3 OF 19	C-3	SITE PLAN - SOIL AND GROUNDWATER SAMPLE LOCATIONS
SHEET 4 OF 19	C-4	SITE PLAN - AREA A SOIL AND GROUNDWATER SAMPLE LOCATIONS
SHEET 5 OF 19	C-5	PLAN INDEX AND LEGEND
SHEET 6 OF 19	C-6	TREATMENT SYSTEM AND UTILITY PLAN - AREA 1
SHEET 7 OF 19	C-7	TREATMENT SYSTEM AND UTILITY PLAN - AREA 2
SHEET 8 OF 19	C-8	SOIL VAPOR EXTRACTION PIPING AND INSTRUMENTATION DIAGRAMS
SHEET 9 OF 19	C-9	AIR SPARGE PIPING AND INSTRUMENTATION DIAGRAM
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SHEET 11 OF 19	C-11	TREATMENT SYSTEM PIPING AND ELECTRICAL PLAN
SHEET 12 OF 19	C-12	PIPE TRENCH DETAILS
SHEET 13 OF 19	C-13	PRODUCT RECOVERY WELL AND MONITORING WELL DETAILS
SHEET 14 OF 19	C-14	AIR SPARGE AND SOIL VAPOR EXTRACTION WELL PAIR AND JUNCTION BOX DETAILS
SHEET 15 OF 19	C-15	MISCELLANEOUS DETAILS
SHEET 16 OF 19	E-1	POWER SUPPLY CONNECTION AND CONTROL PANEL DETAILS
SHEET 17 OF 19	E-2	ELECTRICAL LINE DIAGRAM AND CONTROL LOGIC
SHEET 18 OF 19	E-3	ELECTRICAL LINE DIAGRAM AND CONTROL LOGIC
SHEET 19 OF 19	E-4	ELECTRICAL LINE DIAGRAM AND CONTROL LOGIC

NOTE:
THESE DRAWINGS ARE PREPARED AND CERTIFIED FOR CONSTRUCTION AND/OR PERMITTING PURPOSES ONLY IN COMPLIANCE WITH NCDENR-APPROVED CORRECTIVE ACTION PLAN (CAP).

RAC ACTION FOR UST REMEDIAL ACTION
BUILDINGS 130 AND 3996
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

REVISIONS

SYMBOL	DESCRIPTION	DATE	APPROVED BY
2	AS BUILT	7/01	
1	FINAL PRE-CONSTRUCTION	3/00	

J.A. JONES
ENVIRONMENTAL
CHARLOTTE, NORTH CAROLINA

A/E CONTRACT NO. N62470-93-D-3033
ACTIVITY - SATISFACTORY TO: DATE
FOR USE FOR COMMANDER NAVFAC DATE

A/E: CHIEF ARCH/ENGR. PROJECT MANAGER PRE PRODUCTION QUALITY CONTROL PROJECT MANAGER DESIGN DIRECTOR

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NAVAL STATION ATLANTIC DIVISION NORFOLK, VIRGINIA

RAC ACTION FOR UST REMEDIAL ACTION
BUILDINGS 130 AND 3996
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

TITLE SHEET WITH SITE LOCATION MAP

CODE ID. NO. 80091 SIZE B
SCALE: N.T.S.
EFD NO.
STA. PROJ. NO.
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 1 OF 19
C-1

GENERAL CONSTRUCTION NOTES

1. LOCATION OF EXISTING UTILITIES SHOWN ARE APPROXIMATE. CONTRACTOR IS RESPONSIBLE FOR LOCATING AND VERIFYING LOCATION OF ALL UTILITIES WITHIN LIMITS TO BE AFFECTED BY CONSTRUCTION.
2. CONTRACTOR TO BE RESPONSIBLE FOR FURNISHING ALL FIELD INFORMATION REQUIRED FOR PREPARATION OF RECORD DRAWINGS BY MAINTAINING A SET OF DRAWINGS IN THE FIELD CURRENT WITH DAILY PROGRESS OF WORK.
3. REFER TO PIPE SPECIFICATIONS FOR TYPE, TESTING REQUIREMENTS, MATERIAL, AND DESIGN CONDITIONS FOR INDIVIDUAL PIPE RUNS.
4. ALL SCREWED PIPE CONNECTIONS TO BE MADE BY WRAPPING MALE THREAD WITH TEFLON TAPE PRIOR TO ASSEMBLY. ALL PVC SOCKET TYPE CONNECTIONS TO BE MADE USING SOLVENT WELDING CEMENT ASTM-D2564.
5. ALL PAVEMENT AND CONCRETE CUTS TO BE SMOOTH EDGE SAW CUTS BY CIRCULAR SAW BLADE TYPE CUTTING MACHINE OR CORE DRILLED TO PREVENT CHIPPING OF EXISTING CONCRETE.
6. ALL CONCRETE AND PAVEMENT AREAS DISTURBED BY TRENCHING TO BE REPLACED TO MATCH EXISTING. ALL GRASSED AREAS DISTURBED BY TRENCHING TO BE REPLACED IN KIND WITH SEED PER SPECIFICATIONS.
7. ALL SOIL BACKFILL TO BE COMPACTED TO 95% OF ASTM D 698 UNLESS OTHERWISE NOTED IN SPECIFICATIONS, OR APPROVED BY NAVY REPRESENTATIVE.
8. ELECTRICAL CONDUIT TO BE MARKED IN TRENCH BY USE OF METAL LOCATING TAPE.
9. CONTRACTOR TO COORDINATE ALL OPENINGS, SLEEVES, DEPRESSIONS, BOLTS, AND OTHER EMBEDMENTS AS ON ALL DRAWINGS AND AS REQUIRED BY ALL TRADES.
10. ALL BURIED LINES TO BE A MINIMUM OF 30 INCHES BELOW GRADE UNLESS OTHERWISE SPECIFIED.
11. NON-SHRINK GROUT TO BE USED WHEN FILLING PIPE SLEEVE PENETRATION VOIDS AND FOR LEVELING PROCESS EQUIPMENT AND PUMPS.
12. PLACEMENT OF GAUGES, INSTRUMENTATION, AND METERS TO BE IN SUCH A MATTER THAT THEY ARE EASILY VISIBLE AND ACCESSIBLE.

GENERAL ABBREVIATIONS

ARV	AIR RELIEF VALVE
AS	AIR SPARGE
BV	BALL VALVE
CV	CHECK VALVE
DPI	DIFFERENTIAL PRESSURE INDICATOR
DV	DILUTION GLOBE VALVE WITH FILTER
FP	PRODUCT RECOVERY
G	GREEN RUNNING LIGHT
GV	GATE VALVE
HDPE	HIGH DENSITY POLYETHYLENE
HS	HAND SWITCH
LAH	LEVEL ALARM HIGH
LAHH	LEVEL ALARM HIGH-HIGH
LSH	LEVEL SWITCH HIGH
LSHH	LEVEL SWITCH HIGH-HIGH
LSL	LEVEL SWITCH LOW
MW	MONITORING WELL
N.T.S.	NOT TO SCALE
PI	PRESSURE INDICATOR
PT	PITOT TUBE
PVC	POLYVINYL CHLORIDE
PRV	PRESSURE RELIEF VALVE
R	RED ALARM LIGHT
S	3-WAY SOLENOID VALVE
SP	SAMPLE PORT
SVE	SOIL VAPOR EXTRACTION
VI	VACUUM INDICATOR

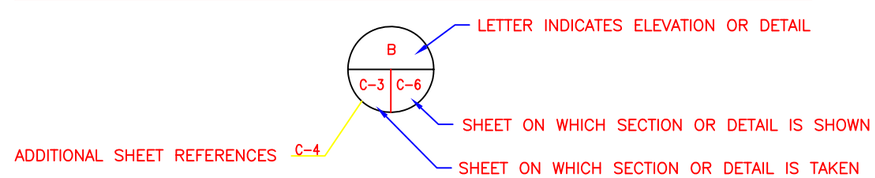
SITE UTILITIES LEGEND

W — WV	WATER VALVE AND LINE
UE	UNDERGROUND ELECTRIC
SS	SANITARY SEWER
OH	OVERHEAD UTILITY WIRES
UT	UNDERGROUND TELEPHONE CABLE
S	STEAM LINE
	ACTIVE FUEL LINE
	ABANDONED FUEL LINE
FS	FUEL SUPPLY LINE
FR	FUEL RETURN LINE
IW	INDUSTRIAL WASTE LINE
x — x	CHAINLINK FENCE
	TYPE II (SHALLOW) MONITORING WELL
	TYPE III (DEEP) MONITORING WELL
	TYPE II (DEEP) MONITORING WELL
	SIGN
S	SANITARY SEWER MANHOLE
	LIGHT POLE/RUNWAY LIGHT
	UTILITY POLE
T	TELEPHONE RISER
FA	FIRE ALARM TERMINAL
GA	GUY ANCHOR
	POST INDICATOR VALVE
	HYDRANT
P	CONCRETE PAD
CB	CATCH BASIN
	DROP INLET & STORM MH
E E	ELECTRIC MANHOLES
	TRANSFORMER
	SOIL BORING LOCATION (LAW ENGINEERING)
	SOIL PROBE LOCATION (LAW ENGINEERING)
	SOIL PROBE LOCATION (J.A. JONES-6/23-24/99)
	GEOPROBE/HYDROPUNCH LOCATION (J.A. JONES-9/9 AND 9/13)
	GEOPROBE LOCATION (J.A. JONES 10/13-10/19/99)
P	PRODUCT HEADER LINE
P	PRODUCT LATERAL LINE
A	SVE/AIR SPARGE HEADER LINE
A	SVE/AIR SPARGE LATERAL LINE
	SOIL VAPOR EXTRACTION/AIR SPARGE WELL PAIR WITH ZONE OF INFLUENCE
	PRODUCT RECOVERY WELL WITH ZONE OF INFLUENCE
A A	PIPE SECTION

PIPING SYMBOLS

	INSTRUMENT SUPPLY OR CONNECTION TO PROCESS
	ELECTRICAL SIGNAL
	LOGIC CONNECTION
3"	GATE VALVE (SIZE INDICATED IF NOT LINE SIZE)
	CHECK VALVE
	BALL VALVE
	PRESSURE SAFETY RELIEF VALVE
3 x 2	INDICATES LINE SIZE REDUCTION
	PRESSURE REGULATOR
PI	PRESSURE REGULATOR WITH PRESSURE GAUGE
	SAMPLE PORT
	DILUTION GLOBE VALVE WITH FILTER
S	3-WAY SOLENOID VALVE
JB	PIPE JUNCTION BOX
A/B/C/D/E	INDICATES E-INCH DIAMETER SDR11 HDPE AIR SPARGE PIPE (MULTIPLE PIPE RUNS DESIGNATED BY E;E;E)
	INDICATES D-INCH DIAMETER SDR11 HDPE SOIL VAPOR EXTRACTION PIPE (MULTIPLE PIPE RUNS DESIGNATED BY D;D;D)
	INDICATES C-INCH DIAMETER AIR PRO HDPE PIPE
	INDICATES B-INCH DIAMETER BUNA-N PRODUCT HOSE (MULTIPLE PIPE RUNS DESIGNATED BY B;B;B)
	INDICATES A-INCH DIAMETER SDR11 HDPE HORIZONTAL BORING CONTAINMENT PIPE.

SECTION OR DETAIL IDENTIFICATION SYMBOL



REVISIONS

SYMBOL	DESCRIPTION	DATE	APPROVED BY
1	FINAL PRE-CONSTRUCTION	3/00	
2	AS BUILT	7/01	

J.A. JONES ENVIRONMENTAL SERVICES CHARLOTTE, NORTH CAROLINA

A/E CONTRACT No. N62470-93-D-3033

ACTIVITY — SATISFACTORY TO: _____ DATE _____

FOR USE BY CONSTRUCTION AGENCY

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NAVAL STATION ATLANTIC DIVISION NORFOLK, VIRGINIA

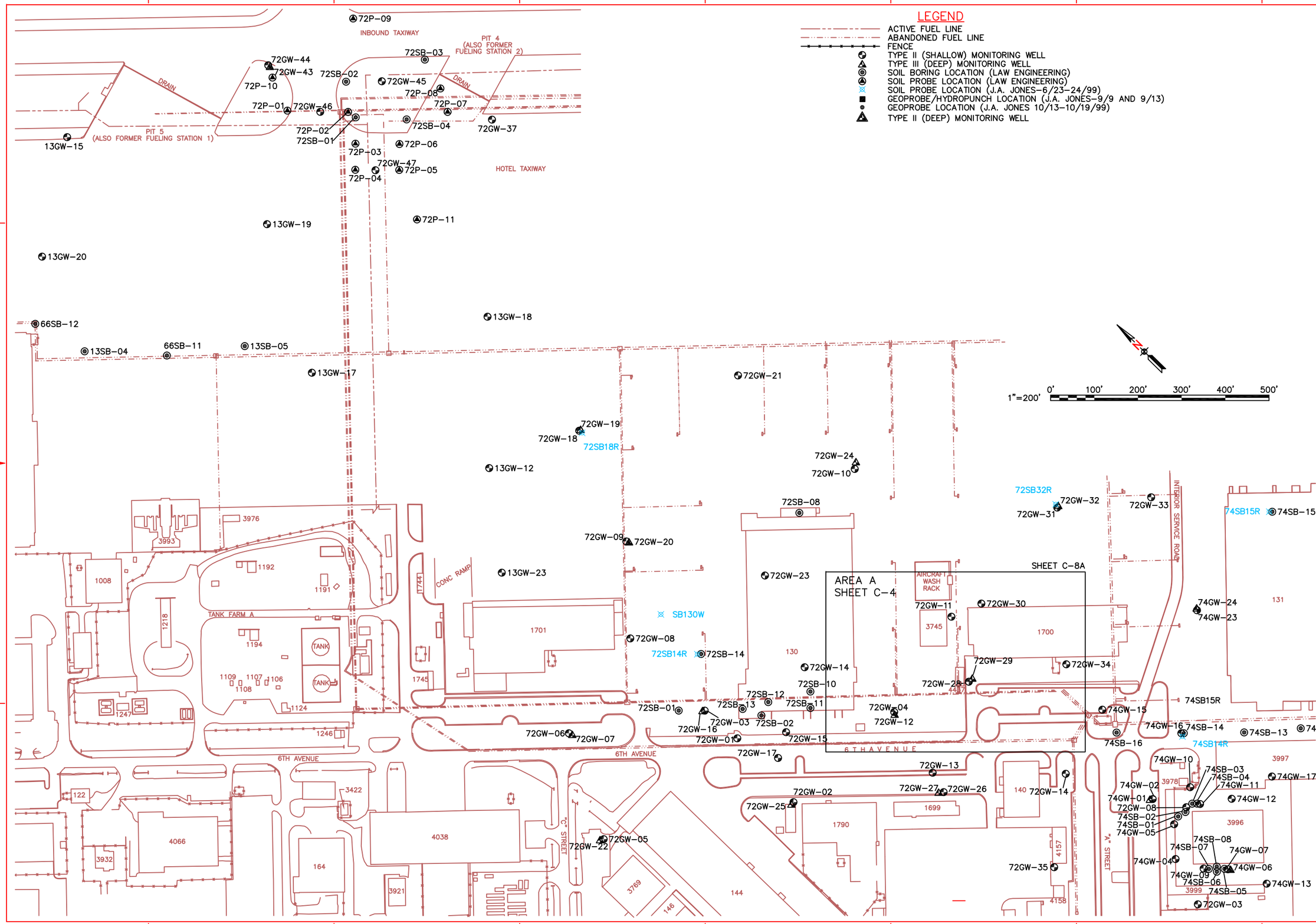
RAC ACTION FOR UST REMEDIAL ACTION
BUILDINGS 130 AND 3996
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

GENERAL NOTES AND LEGENDS

CODE ID. NO. 80091 | SIZE B
SCALE: N.T.S.
EFD NO.
STA. PROJ. NO.
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 2 OF 19
C-2

N.T.S.

1 19
C-1



SYMBOL	DESCRIPTION	DATE	APPROVED BY
2	AS BUILT	7/01	
1	FINAL PRE-CONSTRUCTION	3/00	

REVISIONS

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CHARLOTTE, NORTH CAROLINA

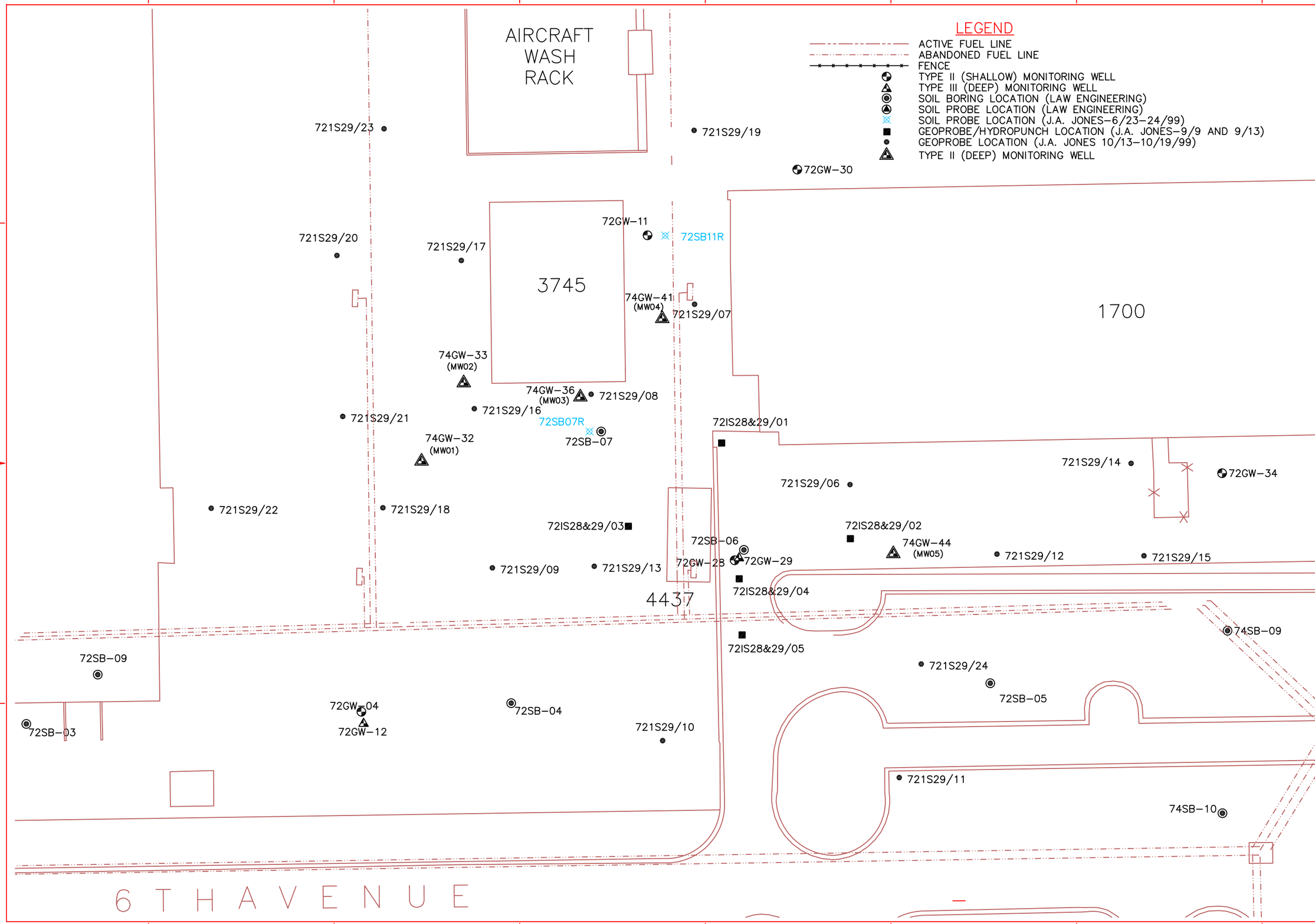
A/E CONTRACT No. N62470-93-D-3033
ACTIVITY - SATISFACTORY TO:
FOR INFO FOR COMMENT INFOC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION NORFOLK, VIRGINIA
NAVAL STATION

RAC ACTION FOR UST REMEDIAL ACTION
BUILDINGS 130 AND 3996
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

SITE PLAN - SOIL AND GROUNDWATER SAMPLE LOCATIONS

CODE ID. NO. 80091 SIZE B
SCALE: NTS 1"=200'
EFD NO.
STA. PROJ. NO.
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 1 3 of 19
C-C1-3



SYMBOL	DESCRIPTION	DATE	APPROVED BY
2	AS BUILT	7/01	
1	FINAL PRE-CONSTRUCTION	3/00	

REVISIONS

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A/E CONTRACT NO. N62470-93-D-3033

ACTIVITY – SATISFACTORY TO:

FOR AIR FOR COMMANDER, NAVFAC

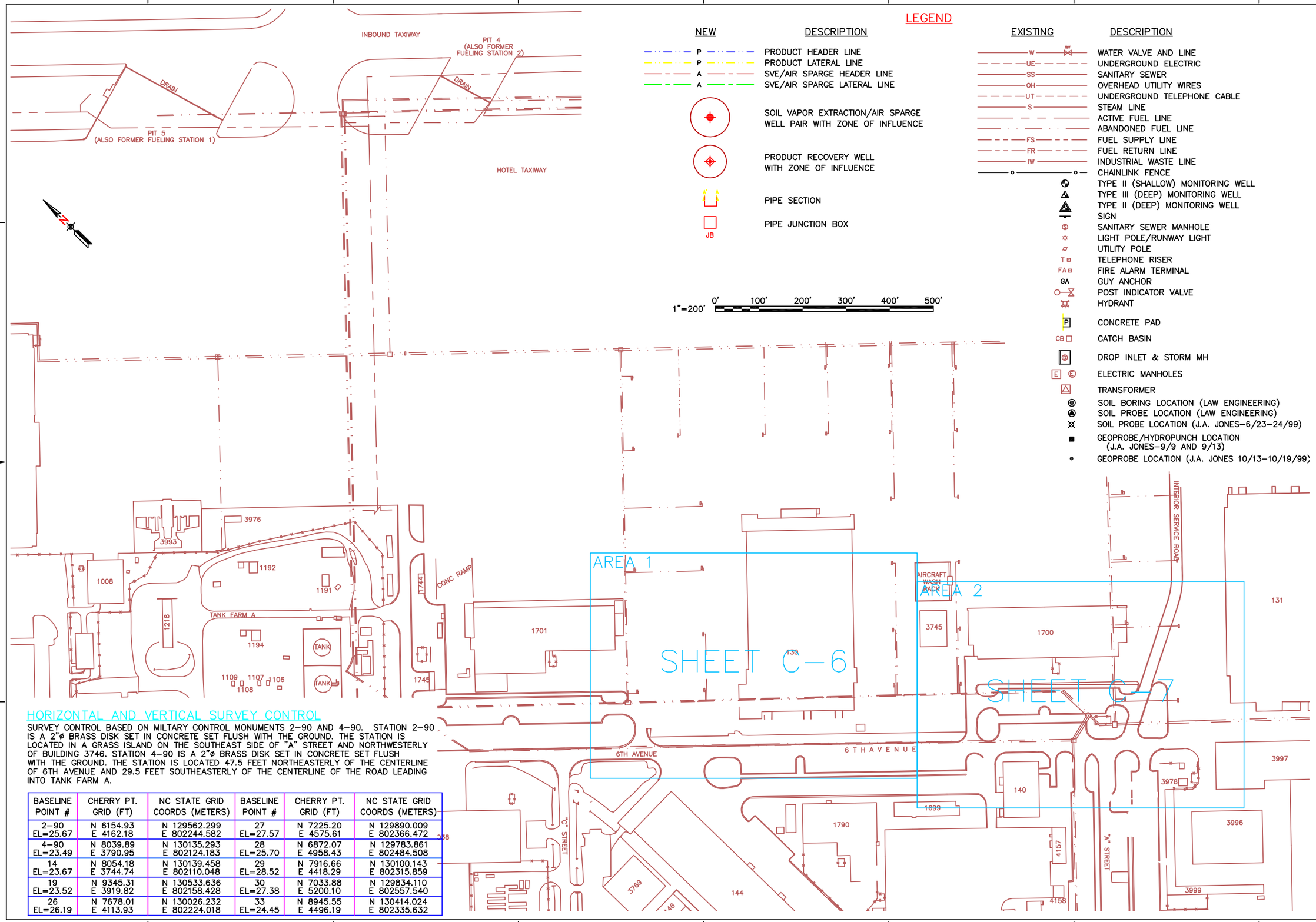
ACE
ASSIGNED
DRAWN
REVIEW
CHIEF ARCH/ENGR
PROJECT MANAGER
FIELD PRODUCTION
QUALITY CONTROL
BRANCH MANAGER
DIVISION DIRECTOR
DATE

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL STATION ATLANTIC DIVISION NORFOLK, VIRGINIA

RAC ACTION FOR UST REMEDIAL ACTION
BUILDINGS 130 AND 3998
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

SITE PLAN AREA A – SOIL AND GROUNDWATER SAMPLE LOCATIONS

CODE ID. NO. 80091 SIZE B
SCALE: N.T.S.
EFD NO.
STA. PROJ. NO.
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 14 of 19
C-14



LEGEND

NEW	DESCRIPTION
P	PRODUCT HEADER LINE
P	PRODUCT LATERAL LINE
A	SVE/AIR SPARGE HEADER LINE
A	SVE/AIR SPARGE LATERAL LINE
	SOIL VAPOR EXTRACTION/AIR SPARGE WELL PAIR WITH ZONE OF INFLUENCE
	PRODUCT RECOVERY WELL WITH ZONE OF INFLUENCE
	PIPE SECTION
JB	PIPE JUNCTION BOX

EXISTING	DESCRIPTION
W / WV	WATER VALVE AND LINE
UE	UNDERGROUND ELECTRIC
SS	SANITARY SEWER
OH	OVERHEAD UTILITY WIRES
UT	UNDERGROUND TELEPHONE CABLE
S	STEAM LINE
	ACTIVE FUEL LINE
	ABANDONED FUEL LINE
FS	FUEL SUPPLY LINE
FR	FUEL RETURN LINE
IW	INDUSTRIAL WASTE LINE
	CHAINLINK FENCE
	TYPE II (SHALLOW) MONITORING WELL
	TYPE III (DEEP) MONITORING WELL
	TYPE II (DEEP) MONITORING WELL
	SIGN
S	SANITARY SEWER MANHOLE
	LIGHT POLE/RUNWAY LIGHT
	UTILITY POLE
T	TELEPHONE RISER
FA	FIRE ALARM TERMINAL
GA	GUY ANCHOR
	POST INDICATOR VALVE
	HYDRANT
P	CONCRETE PAD
CB	CATCH BASIN
D	DROP INLET & STORM MH
E / E	ELECTRIC MANHOLES
	TRANSFORMER
	SOIL BORING LOCATION (LAW ENGINEERING)
	SOIL PROBE LOCATION (LAW ENGINEERING)
	SOIL PROBE LOCATION (J.A. JONES-6/23-24/99)
	GEOPROBE/HYDROPUNCH LOCATION (J.A. JONES-9/9 AND 9/13)
	GEOPROBE LOCATION (J.A. JONES 10/13-10/19/99)

1"=200' 0' 100' 200' 300' 400' 500'

HORIZONTAL AND VERTICAL SURVEY CONTROL

SURVEY CONTROL BASED ON MILTARY CONTROL MONUMENTS 2-90 AND 4-90. STATION 2-90 IS A 2"ø BRASS DISK SET IN CONCRETE SET FLUSH WITH THE GROUND. THE STATION IS LOCATED IN A GRASS ISLAND ON THE SOUTHEAST SIDE OF "A" STREET AND NORTHWESTERLY OF BUILDING 3746. STATION 4-90 IS A 2"ø BRASS DISK SET IN CONCRETE SET FLUSH WITH THE GROUND. THE STATION IS LOCATED 47.5 FEET NORTHEASTERLY OF THE CENTERLINE OF 6TH AVENUE AND 29.5 FEET SOUTHEASTERLY OF THE CENTERLINE OF THE ROAD LEADING INTO TANK FARM A.

BASELINE POINT #	CHERRY PT. GRID (FT)	NC STATE GRID COORDS (METERS)	BASELINE POINT #	CHERRY PT. GRID (FT)	NC STATE GRID COORDS (METERS)
2-90 EL=25.67	N 6154.93 E 4162.18	N 129562.299 E 802244.582	27 EL=27.57	N 7225.20 E 4575.61	N 129890.009 E 802366.472
4-90 EL=23.49	N 8039.89 E 3790.95	N 130135.293 E 802124.183	28 EL=25.70	N 6872.07 E 4958.43	N 129783.861 E 802484.508
14 EL=23.67	N 8054.18 E 3744.74	N 130139.458 E 802110.048	29 EL=28.52	N 7916.66 E 4418.29	N 130100.143 E 802315.859
19 EL=23.52	N 9345.31 E 3919.82	N 130533.636 E 802158.428	30 EL=27.38	N 7033.88 E 5200.10	N 129834.110 E 802557.540
26 EL=26.19	N 7678.01 E 4113.93	N 130026.232 E 802224.018	33 EL=24.45	N 8945.55 E 4496.19	N 130414.024 E 802335.632

SYMBOL	DESCRIPTION	DATE	APPROVED BY
2	AS BUILT	7/01	
1	FINAL PRE-CONSTRUCTION	3/00	

REVISIONS

J.A. JONES
ENVIRONMENTAL
CHARLOTTE, NORTH CAROLINA

A/E CONTRACT NO. N62470-93-D-3033

ACTIVITY - SATISFACTORY TO: DATE

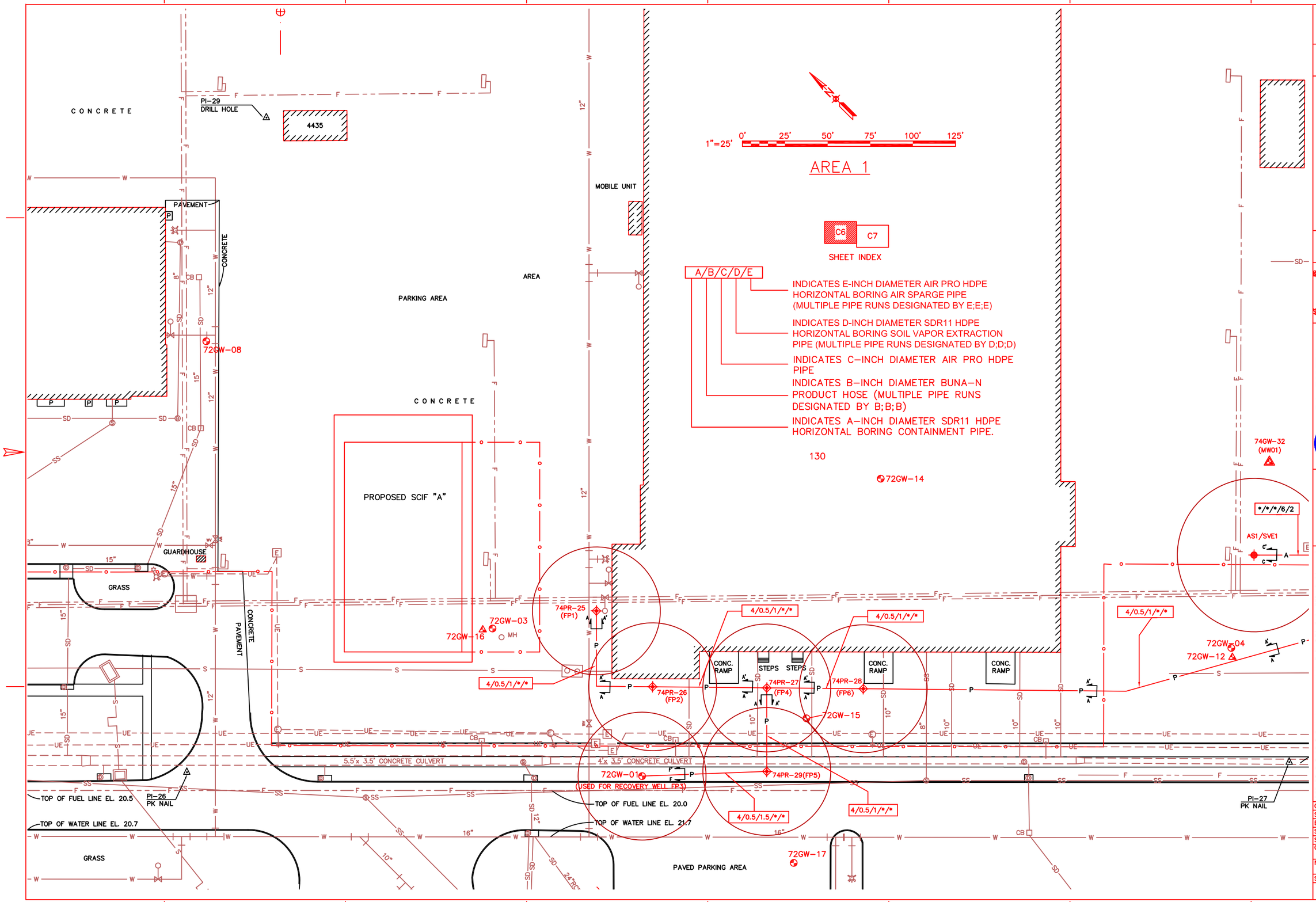
FOR IN FOR COMMANDER NAVFAC DATE

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NAVAL STATION ATLANTIC DIVISION NORFOLK, VIRGINIA

RAC ACTION FOR UST REMEDIAL ACTION
BUILDINGS 130 AND 3996
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

PLAN INDEX AND LEGEND

CODE ID. NO. 80091 SIZE B
SCALE: NTS 200'
EFD NO.
STA. PROJ. NO.
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 1 5 OF 919
C-1-5



SYMBOL	DESCRIPTION	DATE	APPROVED BY
2	AS BUILT	5/01	
1	FINAL PRE-CONSTRUCTION	3/00	

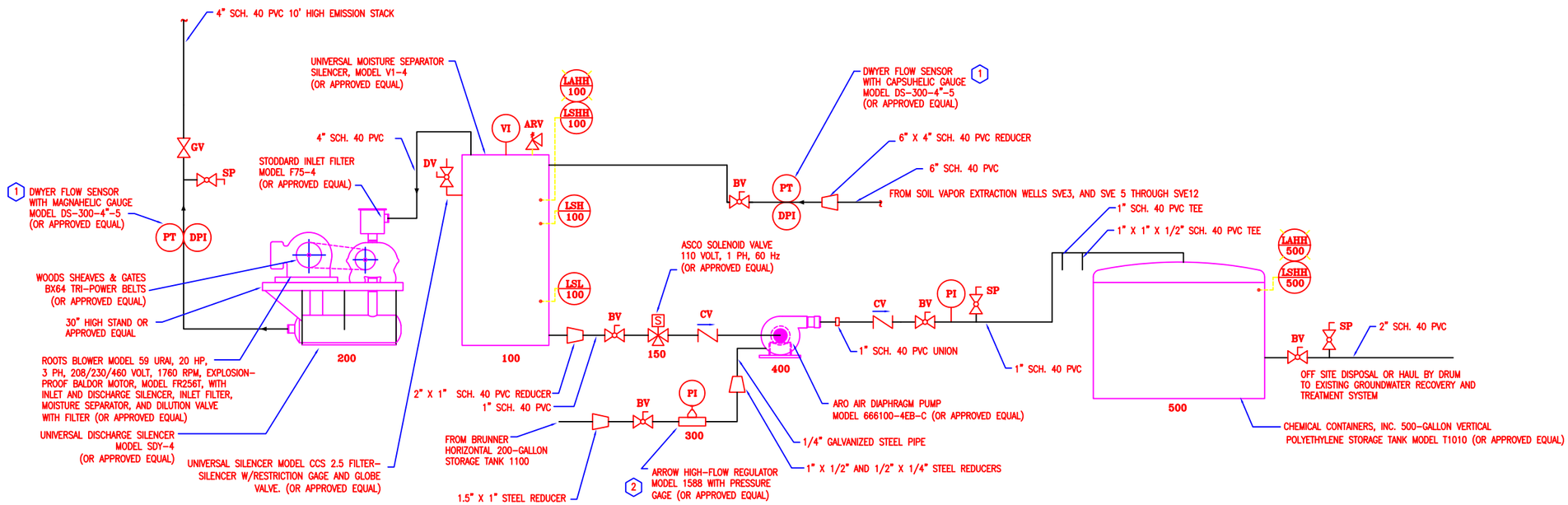
REVISIONS

J.A. JONES
ENVIRONMENTAL SERVICES
CHARLOTTE, NORTH CAROLINA

A/E CONTRACT No. N62470-93-D-3033
ACTIVITY - SATISFACTORY To:
FOR IR FOR COMMENTS ONLY

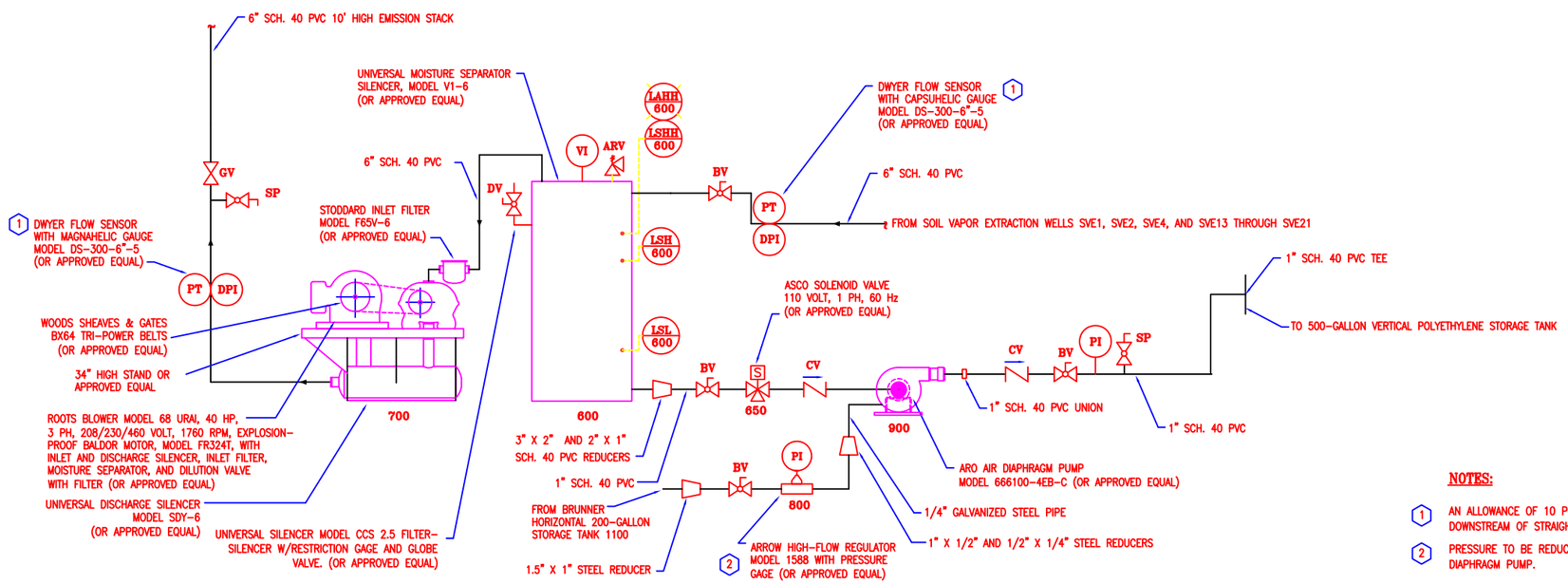
DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION NORFOLK, VIRGINIA
NAVAL STATION
RAC ACTION FOR UST REMEDIAL ACTION
BUILDINGS 130 AND 3996
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA
TREATMENT SYSTEM AND UTILITY PLAN - AREA 1

CODE ID. NO. 80091 SIZE B
SCALE: 1"=25'
EFD NO.
STA. PROJ. NO.
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 6 OF 19
C-6



SOIL VAPOR EXTRACTION LINE NO. 1 PIPING AND INSTRUMENTATION DIAGRAM

NOT TO SCALE



SOIL VAPOR EXTRACTION LINE NO. 2 PIPING AND INSTRUMENTATION DIAGRAM

NOT TO SCALE

NOTES:

1. AN ALLOWANCE OF 10 PIPE DIAMETERS UPSTREAM AND 5 PIPE DIAMETERS DOWNSTREAM OF STRAIGHT PIPE RUN IS REQUIRED.
2. PRESSURE TO BE REDUCED TO 40 PSI IN THE AIR LINE TO THE AIR DIAPHRAGM PUMP.

SYMBOL	DESCRIPTION	DATE	APPROVED BY
2	AS BUILT	7/01	
1	FINAL PRE-CONSTRUCTION	3/00	

REVISIONS

J.A. JONES ENVIRONMENTAL CHARLOTTE, NORTH CAROLINA

A/E CONTRACT NO. N62470-93-D-3033

ACTIVITY - SATISFACTORY TO: DATE

FOR W/D FOR COMMERCIAL BIDING DATE

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NAVAL STATION ATLANTIC DIVISION NORFOLK, VIRGINIA

RAC ACTION FOR UST REMEDIAL ACTION
BUILDINGS 130 AND 3996
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

SOIL VAPOR EXTRACTION SYSTEM PIPING AND INSTRUMENTATION DIAGRAMS

CODE ID. NO. 80091 SIZE B

SCALE: N.T.S.S.

EFD NO.

STA. PROJ. NO.

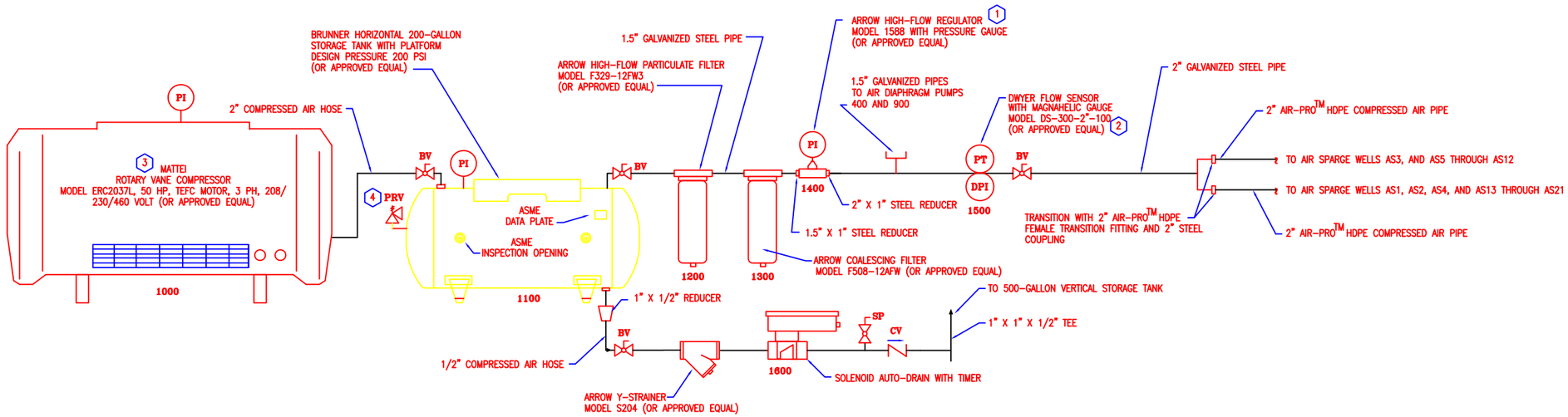
SPEC. NO.

CONSTR. CONTR. NO. N62470-93-D-3033

NAVFAC DRAWING NO.

SHEET 18 of 919

C-C1-8



AIR SPARGE PIPING AND INSTRUMENTATION DIAGRAM

NOT TO SCALE

NOTES:

1. PRESSURE TO BE REDUCED TO 60 PSI IN THE TREATMENT BUILDING.
2. AN ALLOWANCE OF 10 PIPE DIAMETERS UPSTREAM AND 5 PIPE DIAMETERS DOWNSTREAM OF STRAIGHT PIPE RUN IS REQUIRED.
3. THE AIR COMPRESSOR CONTROL PANEL MOUNTED TO THE MATTEI AIR COMPRESSOR WILL BE REMOVED FROM THE AIR COMPRESSOR AND MOUNTED IN THE EXTERIOR TREATMENT SYSTEM CONTROL PANEL TO MEET CLASS 1, DIVISION 2 REQUIREMENTS.
4. PRESSURE RELIEF VALVE WILL BE RATED FOR 215 CFM AT 150 PSI.

SYMBOL	DESCRIPTION	DATE	APPROVED BY
2	AS BUILT	7/01	
1	FINAL PRE-CONSTRUCTION	3/00	

REVISIONS

J.A. JONES
ENVIRONMENTAL
CHARLOTTE, NORTH CAROLINA

A/E CONTRACT NO. N62470-93-D-3033

ACTIVITY - SATISFACTORY TO: DATE

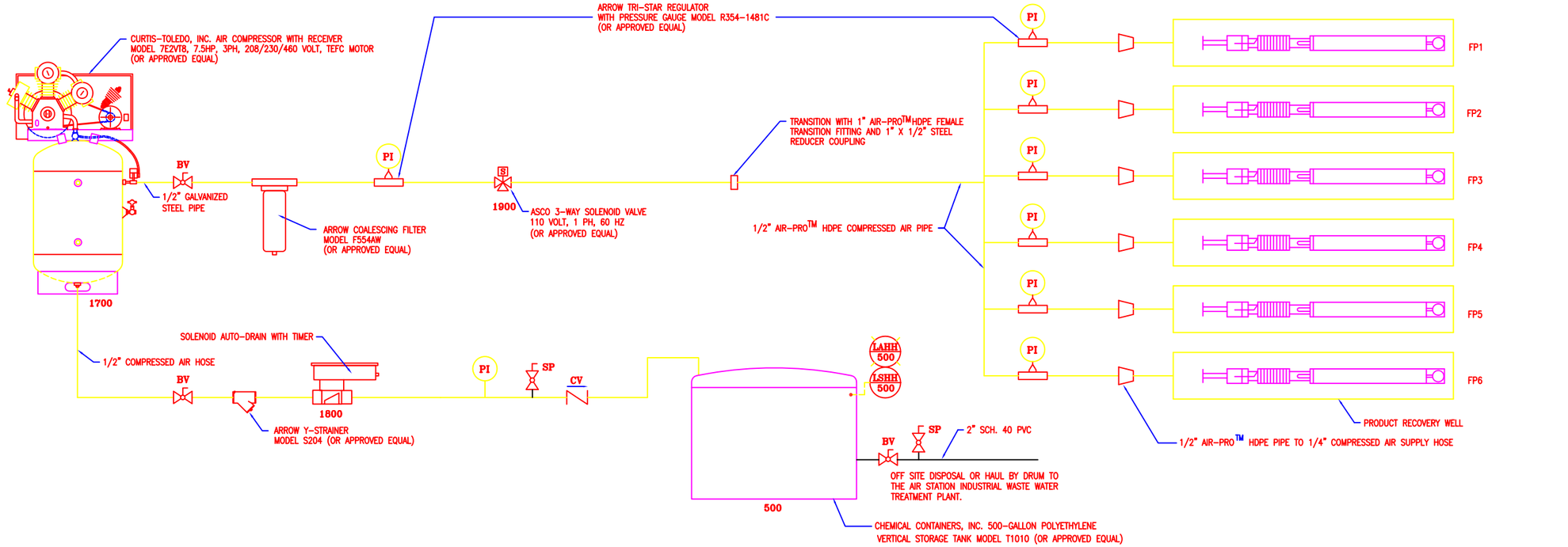
FOR AIR FOR COMMENTS ONLY

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NAVAL STATION ATLANTIC DIVISION NORFOLK, VIRGINIA

RAC ACTION FOR UST REMEDIAL ACTION
BUILDINGS 130 AND 3996
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

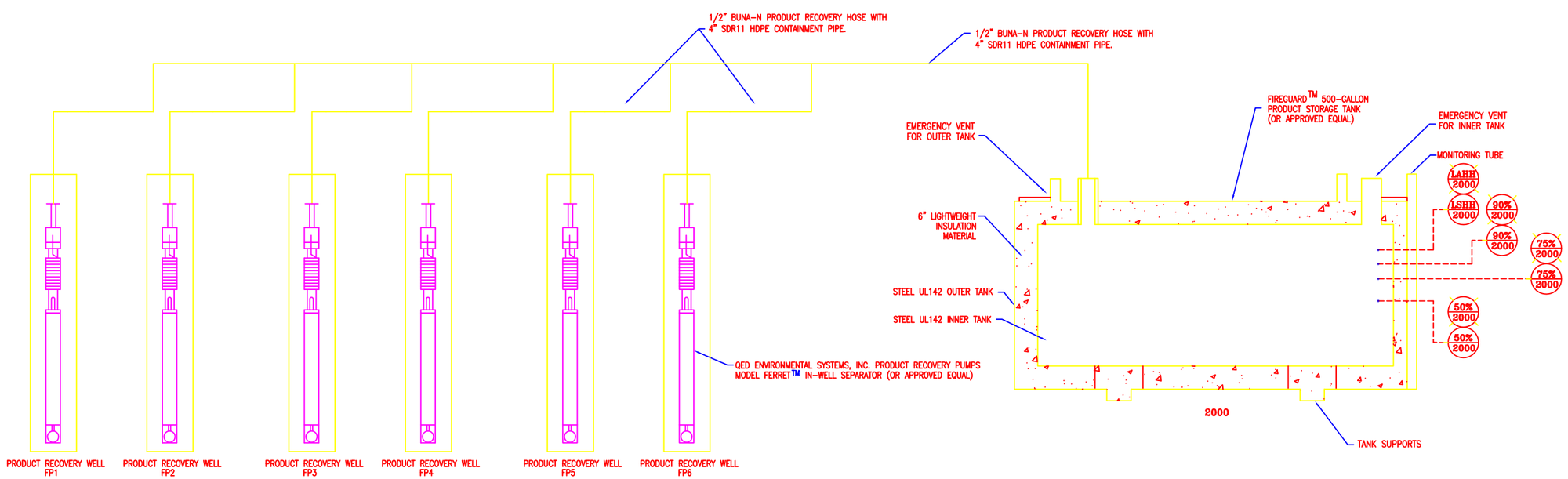
AIR SPARGE PIPING AND INSTRUMENTATION DIAGRAM

CODE ID. NO. 80091 | SIZE B
SCALE: N.T.S.
EFD NO.
STA. PROJ. NO.
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 1 9 OF 9 19
C-C1-9



PRODUCT RECOVERY COMPRESSED AIR AND CONDENSATE PIPING AND INSTRUMENTATION DIAGRAM

NOT TO SCALE



PRODUCT RECOVERY PIPING AND INSTRUMENTATION DIAGRAM

NOT TO SCALE

SYMBOL	DESCRIPTION	DATE	APPROVED BY
1	FINAL PRE-CONSTRUCTION	3/00	
2	AS BUILT	7/01	

REVISIONS

J.A. JONES ENVIRONMENTAL CHARLOTTE, NORTH CAROLINA

A/E CONTRACT NO. N62470-93-D-3033

ACTIVITY - SATISFACTORY TO: DATE

FOR US TOP COMMANDER BUREAU DATE

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NAVAL STATION ATLANTIC DIVISION NORFOLK, VIRGINIA

RAC ACTION FOR UST REMEDIAL ACTION
BUILDINGS 130 AND 3996
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

PRODUCT RECOVERY SYSTEM PIPING AND INSTRUMENTATION DIAGRAMS

CODE ID. NO. 80091 SIZE B

SCALE: N.T.S.T.S.

EFD NO.

STA. PROJ. NO.

SPEC. NO.

CONSTR. CONTR. NO. N62470-93-D-3033

NAVFAC DRAWING NO.

SHEET 1 10 OF 9 19

CC-110

This drawing is replaced by BUILDING PLAN of REMEDIATION EQUIPMENT BUILDING in Operations And Maintenance Manual prepared by Fliteway Technologies, Inc.

A C-7 C-11 TREATMENT SYSTEM PIPING AND ELECTRICAL PLAN

NOT TO SCALE

SYMBOL	DESCRIPTION	DATE	APPROVED BY
2	AS BUILT	7/01	
1	FINAL PRE-CONSTRUCTION	3/00	

REVISIONS

J.A. JONES ENVIRONMENTAL SERVICES CHARLOTTE, NORTH CAROLINA

A/E CONTRACT NO. N62470-93-D-3033

ACTIVITY — SATISFACTORY TO: DATE

FOR NFG FOR COMMANDER NAVFAC: DATE

ACE ZED

CONTRACTS

CHIEF ARCH/ENGR

PROJECT MANAGER

PRE. PROTOCOL

QUALITY CONTROL

PROJECT MANAGER

CHIEF DESIGNER

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND

NAVAL STATION ATLANTIC DIVISION NORFOLK, VIRGINIA

RAC ACTION FOR UST REMEDIAL ACTION
BUILDINGS 130 AND 3998
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

TREATMENT SYSTEM PIPING AND ELECTRICAL PLAN

CODE ID. NO. 80091 SIZE B

SCALE: N.T.S.

EFD NO.

STA. PROJ. NO.

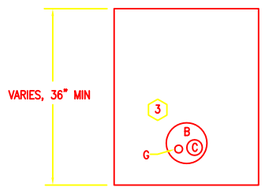
SPEC. NO.

CONSTR. CONTR. NO. N62470-93-D-3033

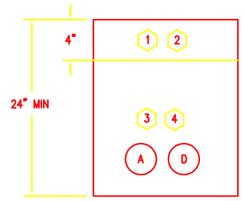
NAVFAC DRAWING NO.

SHEET 111 OF 919

CG-111



SECTION A-A'



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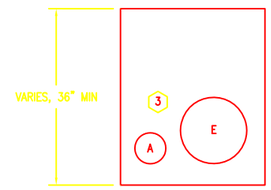
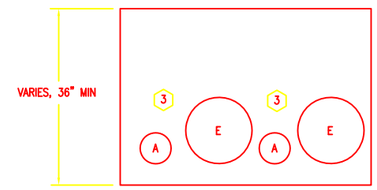


SECTION C-C'



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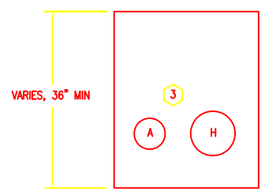
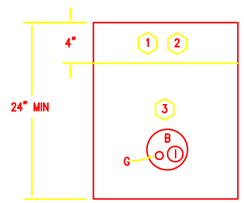
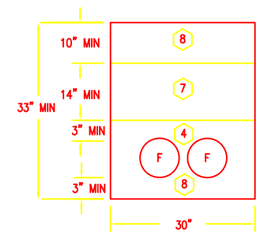


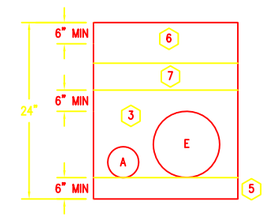
SECTION E-E'



SECTION F-F'



SECTION G-G'



SECTION H-H'

NOTES:

1. MINIMUM 4" OF TOPSOIL. SEED MATCHES EXISTING VEGETATION.
2. SOIL FILL MATERIAL IS COMPACTED TO 85% OF ASTM D 698.
3. 10 GAUGE SOLID MATEL WIRE IS PLACED WITH PIPES.
4. PIPES ARE SEPARATED BY A MINIMUM OF 1-1/2 TIMES PIPE DIAMETER.
5. SOIL FILL MATERIAL IS COMPACTED TO 95% OF ASTM D 698.
6. MINIMUM 4" OF PRIME COAT AND BITUMINOUS COAT, FOLLOWED BY A MINIMUM 8" STONE BASE COURSE AGGREGATE, ABC LIMEROCK, MEETING THE GRADATION REQUIREMENTS OF NORTH CAROLINA DOT. THE LIMEROCK IS COMPACTED TO 95% OF ASTM D 698.
7. COARSE SANDS AND GRAVELS WITH MAXIMUM PARTICLE SIZE OF 40mm (1.5 INCHES) INCLUDING VAROIUS GRADED SANDS AND GRAVELS CONTAINING SMALL PERCENTAGES OF FINES, GENERALLY GRANULAR AND NON-COHESIVE. SOIL TYPES GW, GP, SW AND SP ARE INCLUDED IN THIS CLASS AS SPECIFIED IN ASTM D2487. COMPACT TO 95% OF ASTM D 698 MAXIMUM DENSITY.
8. 4000 PSI CONCRETE. CONCRETE AND SUBBASE MATCH EXISTING.

PIPE LEGEND

A. 2" AIR-PRO™ HDPE COMPRESSED AIR PIPE
B. 4" SDR11 HDPE CONTAINMENT PIPE
C. 1" AIR-PRO™ HDPE COMPRESSED AIR PIPE
D. 2" SDR11 HDPE PIPE
E. 6" SDR11 HDPE PIPE
F. 2.5" PVC ELECTRICAL CONDUIT
G. 0.5" BUNA-N PRODUCT RECOVERY HOSE
H. 4" SDR11 HDPE PIPE
I. 1.5" SDR11 HDPE PIPE

D
C-6 C-12
C-7

PIPE CROSS SECTION DETAILS
NOT TO SCALE

SYMBOL	DESCRIPTION	DATE	APPROVED BY
2	AS BUILT	7/01	
1	FINAL PRE-CONSTRUCTION	3/00	

REVISIONS

J.A. JONES
ENVIRONMENTAL
CHARLOTTE, NORTH CAROLINA

A/E CONTRACT NO. N62470-93-D-3033

ACTIVITY - SATISFACTORY TO: DATE
FOR IR/ FOR COMMENTS ONLY: DATE

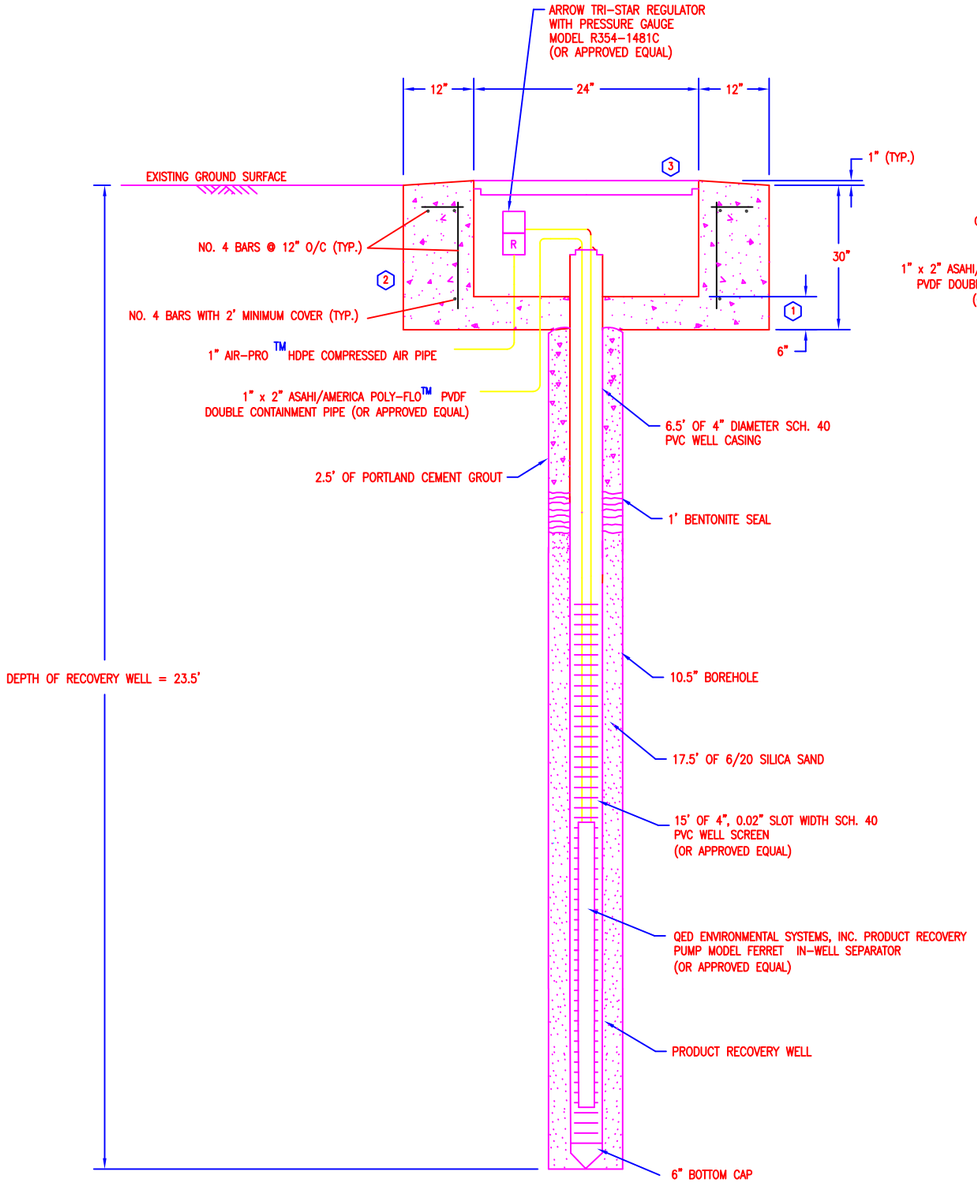
DESIGNED
DRAWN
REVIEW
CHIEF ARCH/ENGR
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DIVISION DIRECTOR

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NAVAL STATION ATLANTIC DIVISION NORFOLK, VIRGINIA

RAC ACTION FOR UST REMEDIAL ACTION
BUILDINGS 130 AND 3996
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

PIPE TRENCH DETAILS

CODE ID. NO. 80091 SIZE B
SCALE: N.T.S.
EFD NO.
STA. PROJ. NO.
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 112 OF 919
CG-112



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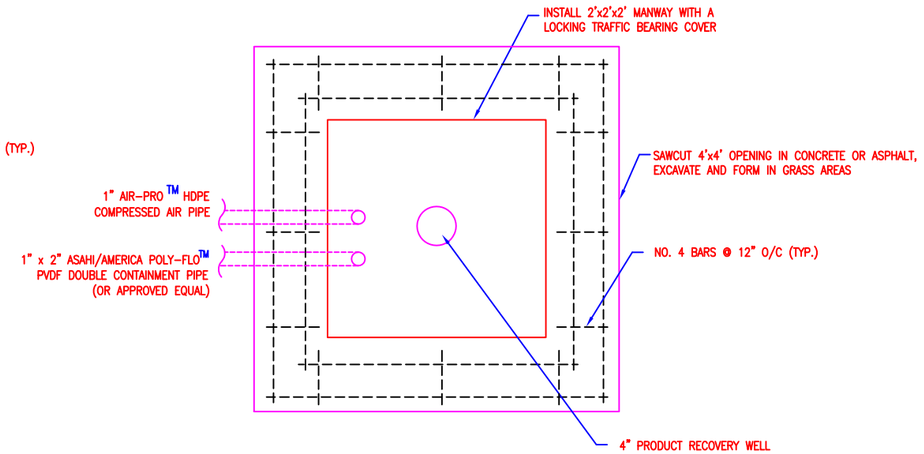
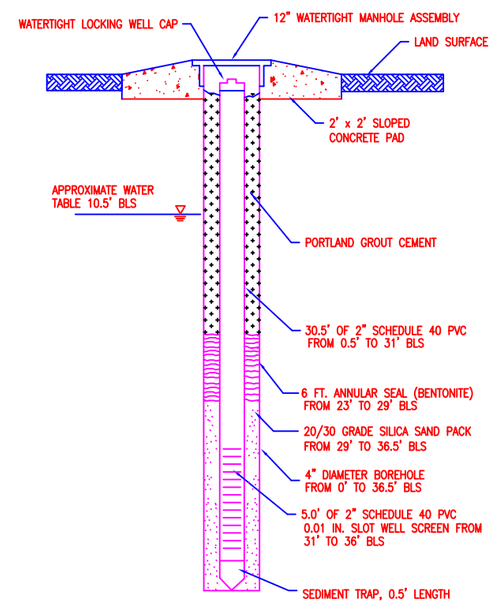


PLAN VIEW

PRODUCT RECOVERY WELL DETAILS

C / C-6 C-13

NOT TO SCALE



PROPOSED WELLS MW01 THROUGH MW05

MONITORING WELL DETAIL

N / C-6 C-13 / C-7

NOT TO SCALE

NOTES:

1. MANWAY PLACED ON 6" BED OF CONCRETE.
2. ALL CONCRETE SHALL BE 4000 PSI MINIMUM WITH 4-6% AIR ENTRAINMENT AND 4" MAXIMUM SLUMP.
3. MANWAY WILL BE CAPABLE OF SUPPORTING AN AASHTO H-20 LIVE LOAD.

NOTE:

DEPTH AND WELL SCREEN INTERVAL PLACEMENT FOR PROPOSED MONITORING WELLS MW01 THROUGH MW05 HAVE BEEN MODIFIED IN THE FIELD DURING INSTALLATION BASED ON GROUNDWATER TABLE ELEVATION.

SYMBOL	DESCRIPTION	DATE	APPROVED BY
2	AS BUILT	7/01	
1	FINAL PRE-CONSTRUCTION	3/00	

REVISIONS

J.A. JONES ENVIRONMENTAL CHARLOTTE, NORTH CAROLINA

A/E CONTRACT NO. N62470-93-D-3033

ACTIVITY - SATISFACTORY TO: DATE

FOR NFG FOR COMMENT ONLY

DESIGNED, DRAWN, REVIEW, CHIEF ARCH/ENGR, PROJECT MANAGER, FIRE PROTECTION, QUALITY CONTROL, BRANCH MANAGER, DIVISION DIRECTOR

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NAVAL STATION ATLANTIC DIVISION NORFOLK, VIRGINIA

RAC ACTION FOR UST REMEDIAL ACTION
BUILDINGS 130 AND 3998
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

PRODUCT RECOVERY WELL AND MONITORING WELL DETAILS

CODE ID. NO. 80091 SIZE B

SCALE: N.T.S.

EFD NO.

STA. PROJ. NO.

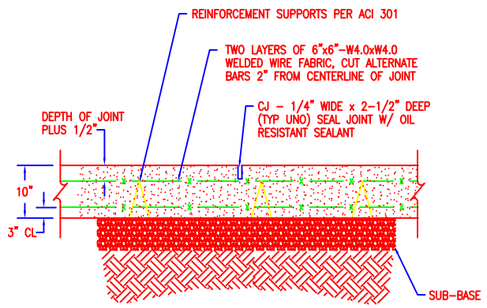
SPEC. NO.

CONSTR. CONTR. NO. N62470-93-D-3033

NAVFAC DRAWING NO.

SHEET 113 OF 919

CC-113

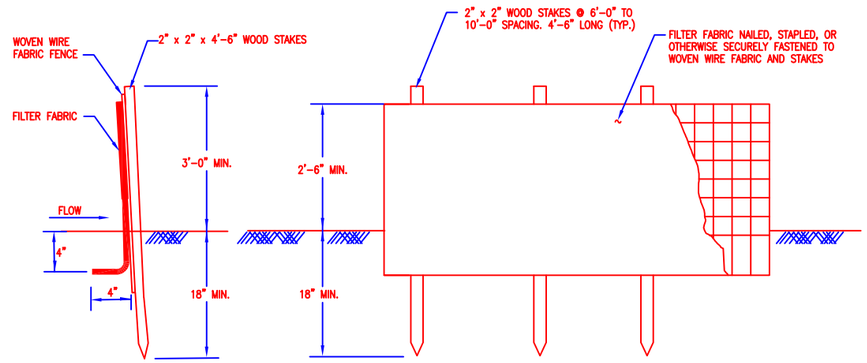


NOTE:
SUB-BASE SHALL CONFORM TO ASTM D1241-68 (1989), TYPE 1, GRADATION B AND SHALL BE COMPACTED TO 95% OF MODIFIED PROCTOR PER ASTM D1557-91. THICKNESS SHALL BE A MINIMUM OF 8".

E C-6 C-15 C-7, C-11

CONCRETE PLACEMENT DETAIL

NOT TO SCALE

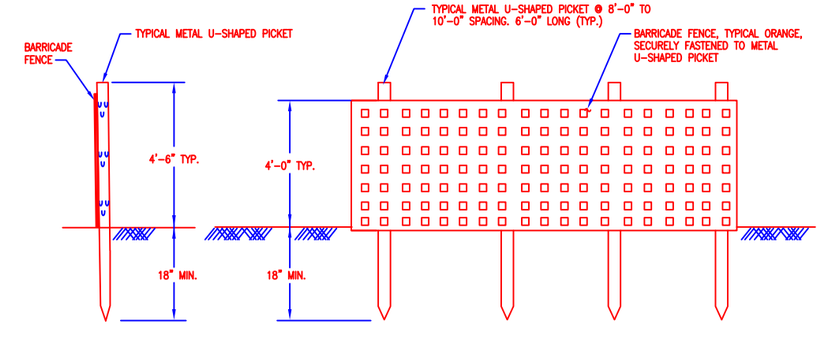


SECTION ELEVATION

F C-7 C-15

STAKED SILT FENCE DETAIL

NOT TO SCALE

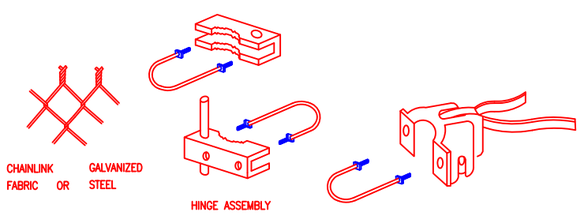


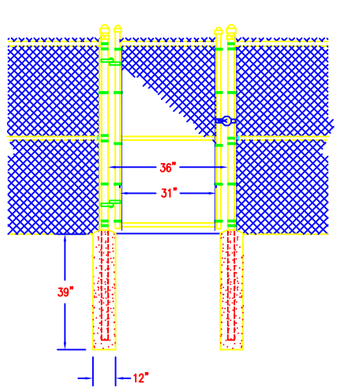
SECTION ELEVATION

G C-6 C-15 C-7

BARRICADE FENCE DETAIL

NOT TO SCALE

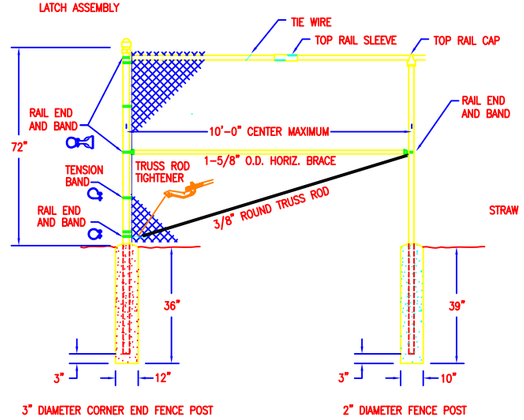




H C-11 C-15

SINGLE SWING GATE DETAIL

NOT TO SCALE

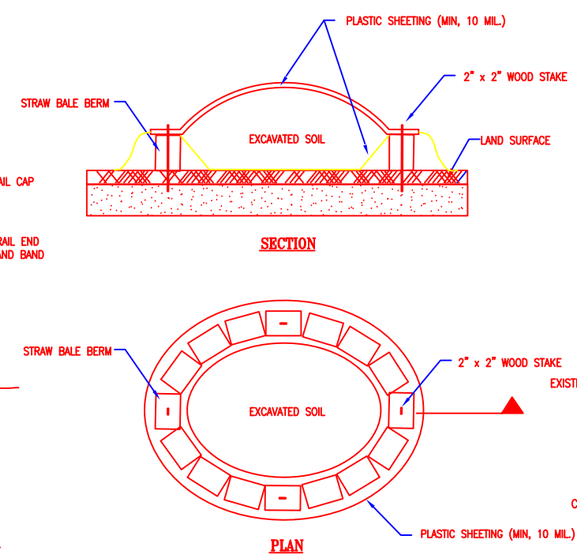


3" DIAMETER CORNER END FENCE POST 2" DIAMETER FENCE POST

I C-11 C-15

CHAIN-LINK FENCE DETAIL

NOT TO SCALE



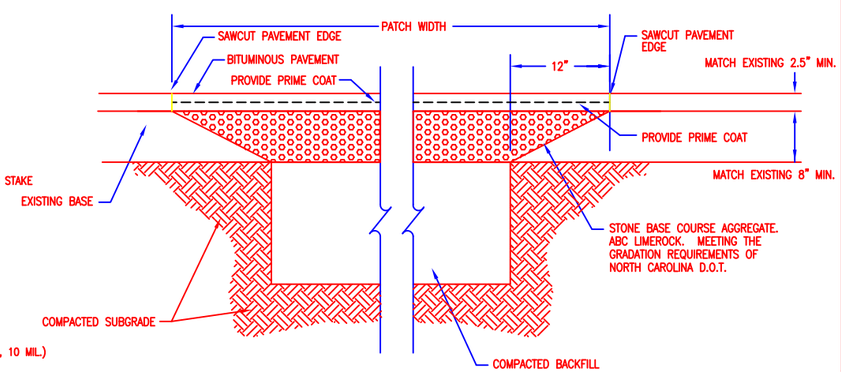
SECTION

PLAN

J C-7 C-15

TEMPORARY CONTAINMENT OF EXCAVATED SOIL DETAIL

NOT TO SCALE



K C-7 C-15

PAVEMENT REPAIR DETAIL

NOT TO SCALE

SYMBOL	DESCRIPTION	DATE	APPROVED BY
2	AS BUILT	7/01	
1	FINAL PRE-CONSTRUCTION	3/00	

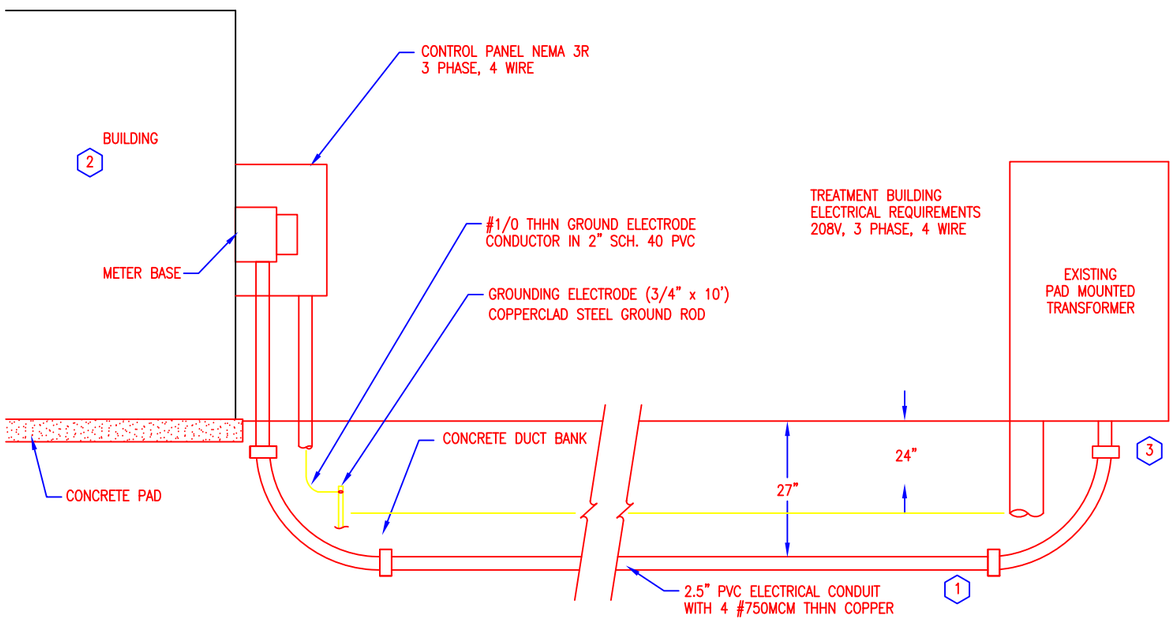
REVISIONS

J.A. JONES
ENVIRONMENTAL
CHARLOTTE, NORTH CAROLINA

A/E CONTRACT NO. N62470-93-D-3033
ACTIVITY - SATISFACTORY TO: DATE
FOR RFI FOR COMMENTS ONLY: DATE

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND NORFOLK, VIRGINIA
NAVAL STATION ATLANTIC DIVISION
RAC ACTION FOR UST REMEDIAL ACTION
BUILDINGS 130 AND 3986
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA
MISCELLANEOUS DETAILS

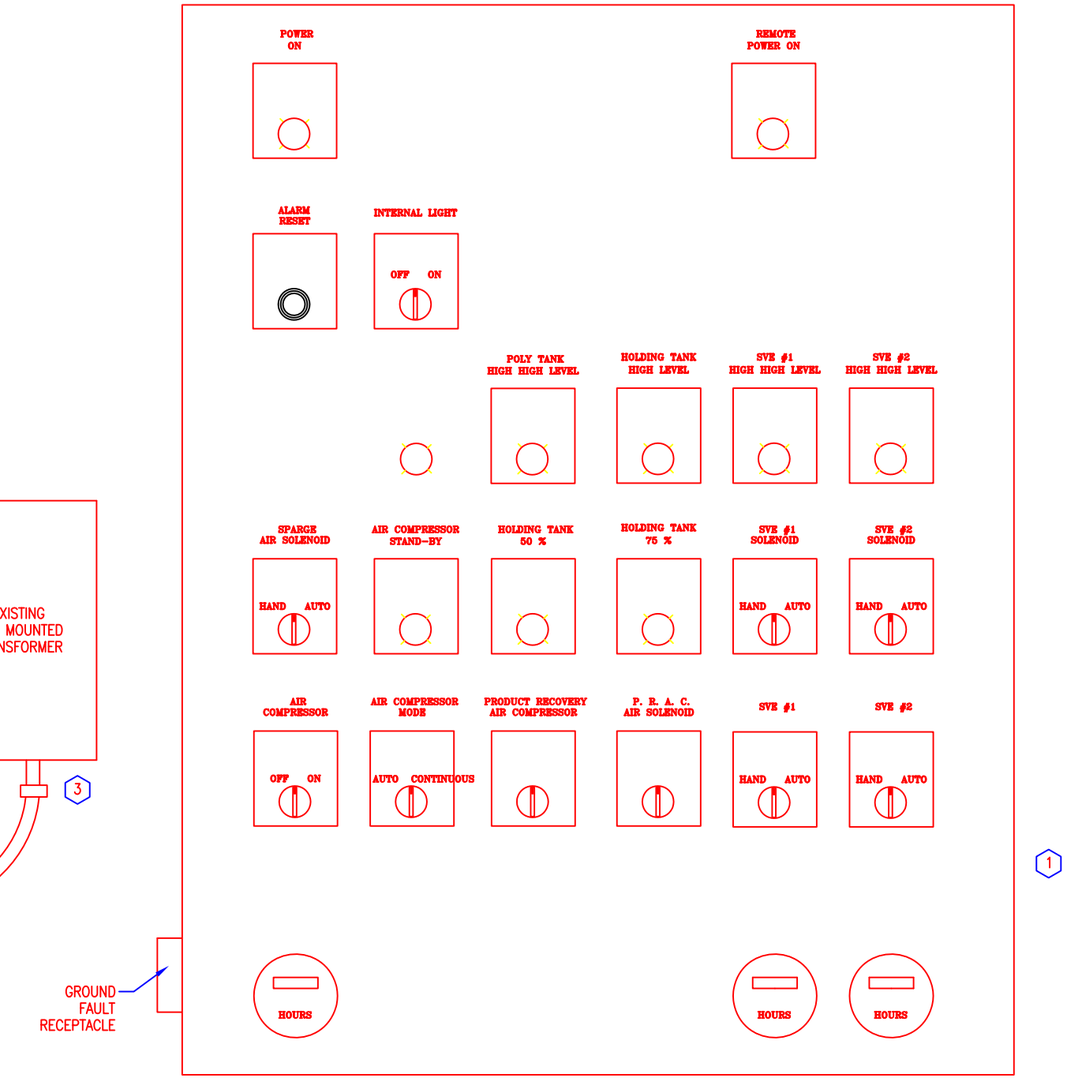
CODE ID. NO. 80091 SIZE B
SCALE: N.T.S.
EFD NO.
STA. PROJ. NO.
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 115 OF 919
CC-115



L C-7 E-1 POWER SUPPLY CONNECTION DETAIL
NOT TO SCALE

NOTES:

1. TRENCH TO EXISTING PAD MOUNTED TRANSFORMER AND PROVIDE CONDUIT AND SECONDARY CONDUCTORS.
2. SOIL AND GROUNDWATER TREATMENT EQUIPMENT ENCLOSURE IS A SELF CONTAINED UNIT COMPLETE WITH EXTERIOR PANELBOARD AND CONTROLS. INTERIOR OF SOIL AND GROUNDWATER TREATMENT ENCLOSURE IS A CLASS 1 DIVISION 2, GROUP D LOCATION.
3. CONDUIT ROUTED INTO SECONDARY COMPARTMENT OF EXISTING PAD MOUNTED TRANSFORMER.



M C-11 E-1 CONTROL PANEL DETAIL
NOT TO SCALE

NOTES:

1. 500 AMP CONTROL PANEL IS UL LISTED AND CERTIFIED FOR USE AS A SERVICE ENTRANCE.

SYMBOL	DESCRIPTION	DATE	APPROVED BY
2	AS BUILT	7/01	
1	FINAL PRE-CONSTRUCTION	3/00	

REVISIONS

J.A. JONES ENVIRONMENTAL SERVICES CHARLOTTE, NORTH CAROLINA

ACE CONTRACT NO. N62470-93-D-3033

ACTIVITY - SATISFACTORY TO: DATE

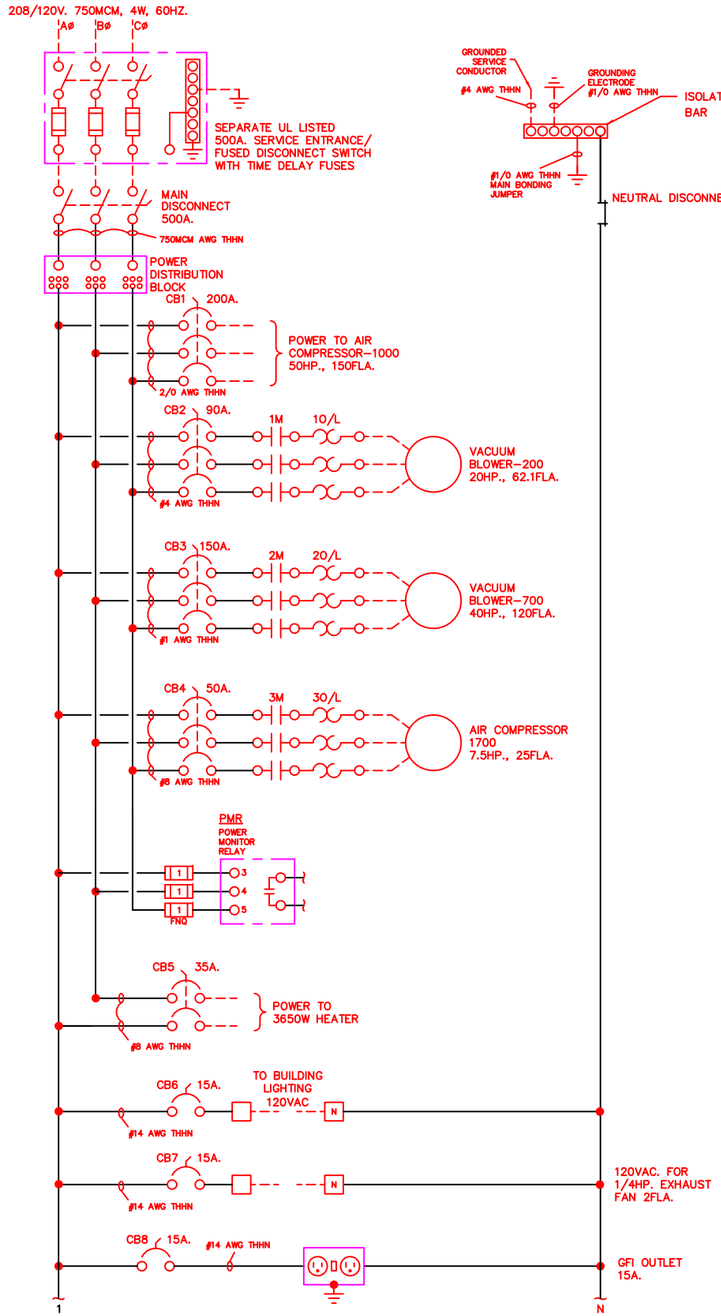
FOR RFI FOR COMMENTS, REPRO. DATE

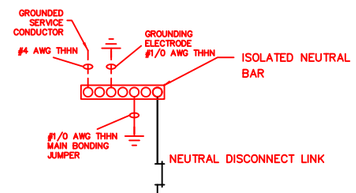
DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NAVAL STATION ATLANTIC DIVISION NORFOLK, VIRGINIA

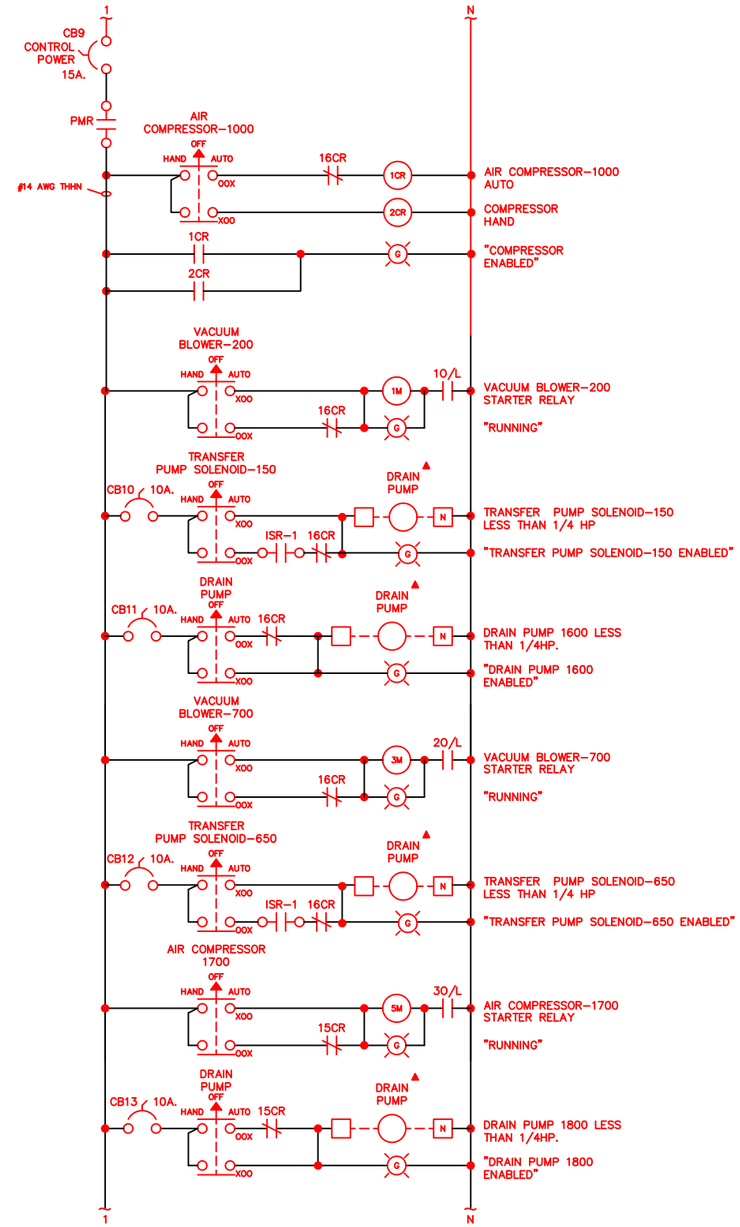
RAC ACTION FOR UST REMEDIAL ACTION
BUILDINGS 130 AND 3996
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

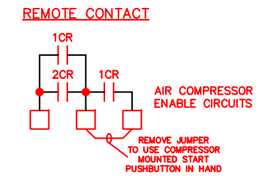
POWER SUPPLY CONNECTION AND CONTROL PANEL DETAILS

CODE ID. NO. 80091 SIZE B
SCALE: N.T.S.
EFD NO.
STA. PROJ. NO.
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 16 OF 19
C-E1-1









CONTROL LOGIC

1. LOW LEVEL IN MOISTURE SEPARATOR 100 CLOSE TRANSFER PUMP SOLENOID 150
2. HIGH LEVEL IN MOISTURE SEPARATOR 100 OPEN TRANSFER PUMP SOLENOID 150
3. HIGH-HIGH LEVEL IN MOISTURE SEPARATOR 100 STOP VACUUM BLOWER 200, STOP VACUUM BLOWER 700, STOP COMPRESSOR 1000. MANUAL RESTART
4. LOW LEVEL IN MOISTURE SEPARATOR 600 CLOSE TRANSFER PUMP SOLENOID 650
5. HIGH LEVEL IN MOISTURE SEPARATOR 600 OPEN TRANSFER PUMP SOLENOID 650
6. HIGH-HIGH LEVEL IN MOISTURE SEPARATOR 600 STOP VACUUM BLOWER 200, STOP VACUUM BLOWER 700. STOP COMPRESSOR 1000. MANUAL RESTART
7. HIGH-HIGH LEVEL IN STORAGE TANK 500 STOP VACUUM BLOWER 200, STOP VACUUM BLOWER 700. STOP COMPRESSOR 1000. BLEEDS SOLENOID VALVE 1900. STOPS COMPRESSOR 1700. MANUAL RESTART.
8. HIGH-HIGH LEVEL IN PRODUCT STORAGE TANK 2000 BLEEDS SOLENOID VALVE 1900. STOPS COMPRESSOR 1700. MANUAL RESTART.

Also refer to the diagrams in System Control Panel #1 and #2 of Operations and Maintenance Manual

SYMBOL	DESCRIPTION	DATE	APPROVED BY
1	AS BUILT FINAL PRE-CONSTRUCTION	7/01	
2		3/00	

REVISIONS

J.A. JONES ENVIRONMENTAL CHARLOTTE, NORTH CAROLINA

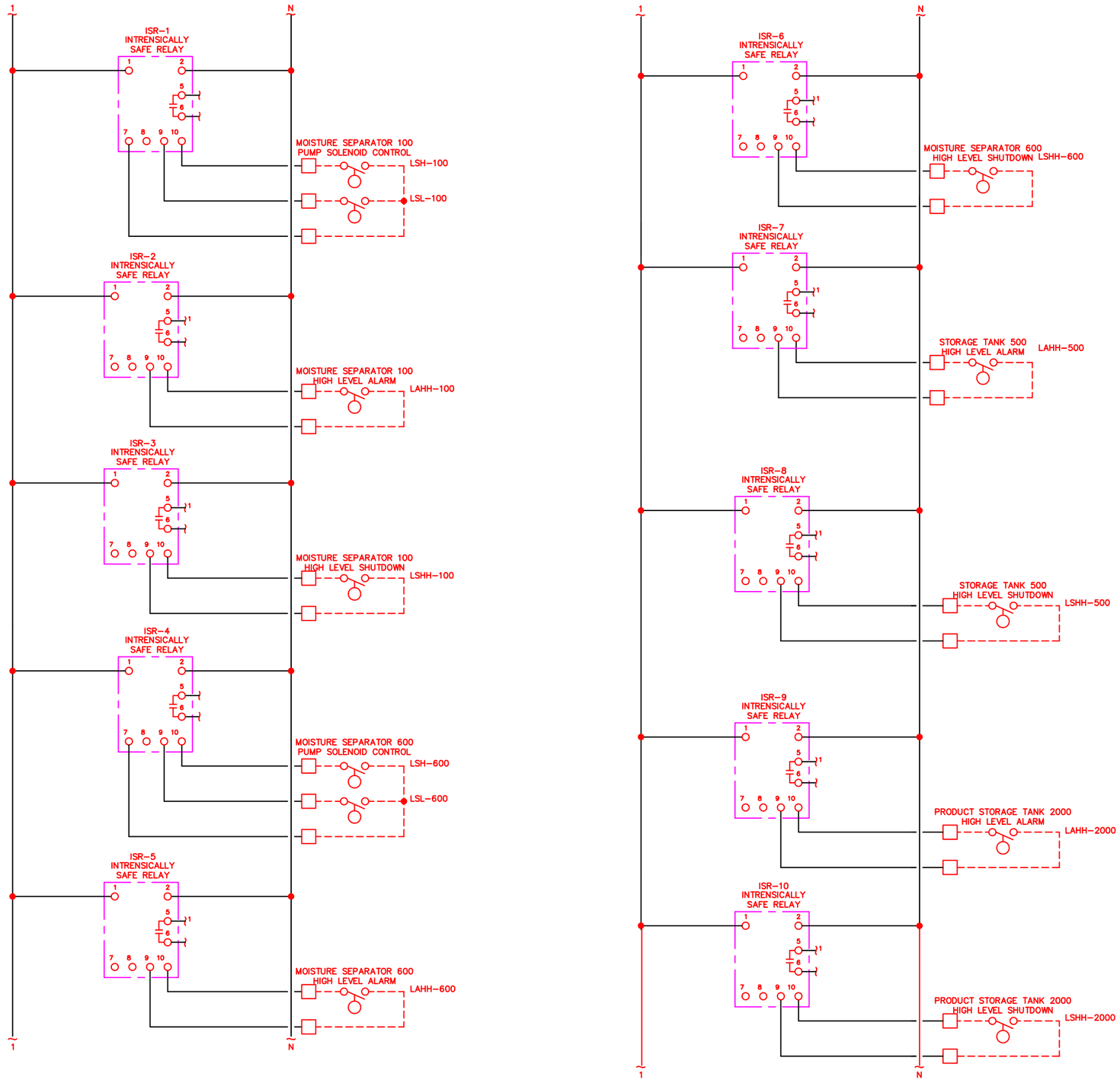
A/E CONTRACT NO. N62470-93-D-3033

ACTIVITY - SATISFACTORY TO:

FOR USE ON FOR COMMERCIAL BUILDING

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NAVAL STATION ATLANTIC DIVISION NORFOLK, VIRGINIA
RAC ACTION FOR UST REMEDIAL ACTION
BUILDINGS 130 AND 3996
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA
ELECTRICAL LINE DIAGRAM AND SYSTEM CONTROL LOGIC

CODE ID. NO. 80091 SIZE B
SCALE: N.T.S.
EFD NO.
STA. PROJ. NO.
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 117 OF 919
C-E-12



Also refer to diagrams in System Control Panel #1 and #2 of Operation and Maintenance Manual

SYMBOL	DESCRIPTION	DATE	APPROVED BY
1	FINAL PRE-CONSTRUCTION	3/00	
2	AS BUILT	7/01	

REVISIONS

J.A. JONES
ENVIRONMENTAL
CHARLOTTE, NORTH CAROLINA

A/E CONTRACT NO. N62470-93-D-3033

ACTIVITY - SATISFACTORY TO: DATE

QUALITY CONTROL
PROJECT MANAGER
CHIEF ARCH/ENGR
DESIGNER

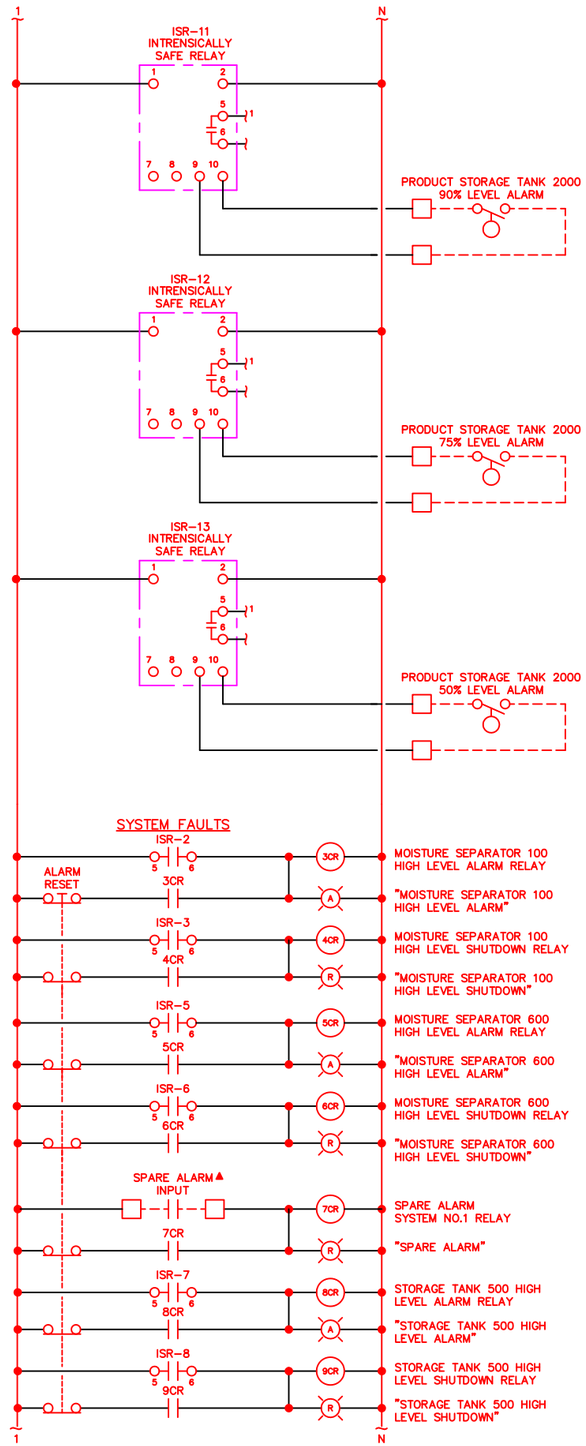
FOR USE ON FOR COMMERCIAL BIDING

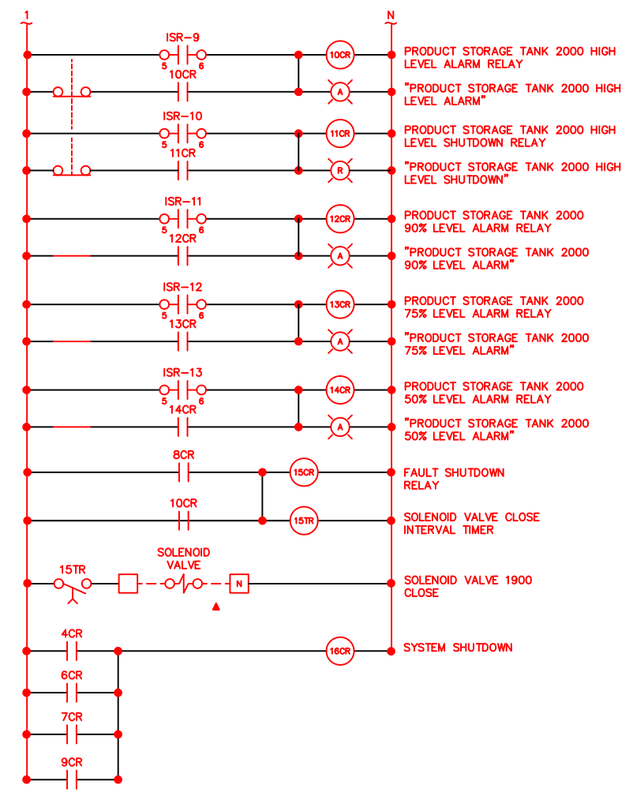
DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NAVAL STATION ATLANTIC DIVISION NORFOLK, VIRGINIA

RAC ACTION FOR UST REMEDIAL ACTION
BUILDINGS 130 AND 3996
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

ELECTRICAL LINE DIAGRAM AND SYSTEM CONTROL LOGIC

CODE ID. NO. 80091 SIZE B
SCALE: N.T.S.T.S.
EFD NO.
STA. PROJ. NO.
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 18 OF 919
C-E1-3





Also refer to diagrams in System Control Panel #1 and #2 in Operation and Maintenance Manual

SYMBOL	DESCRIPTION	DATE	APPROVED BY
2	AS BUILT	7/01	
1	FINAL PRE-CONSTRUCTION	3/00	

REVISIONS

J.A. JONES
ENVIRONMENTAL
CHARLOTTE, NORTH CAROLINA

A/E CONTRACT No. N62470-93-D-3033

ACTIVITY - SATISFACTORY TO: DATE

FOR AO FOR COMMODA BUDG. DATE

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NAVAL STATION ATLANTIC DIVISION NORFOLK, VIRGINIA

RAC ACTION FOR UST REMEDIAL ACTION
BUILDINGS 130 AND 3996
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

ELECTRICAL LINE DIAGRAM AND SYSTEM CONTROL LOGIC

CODE ID. NO. 80091 SIZE B
SCALE: N.T.S.
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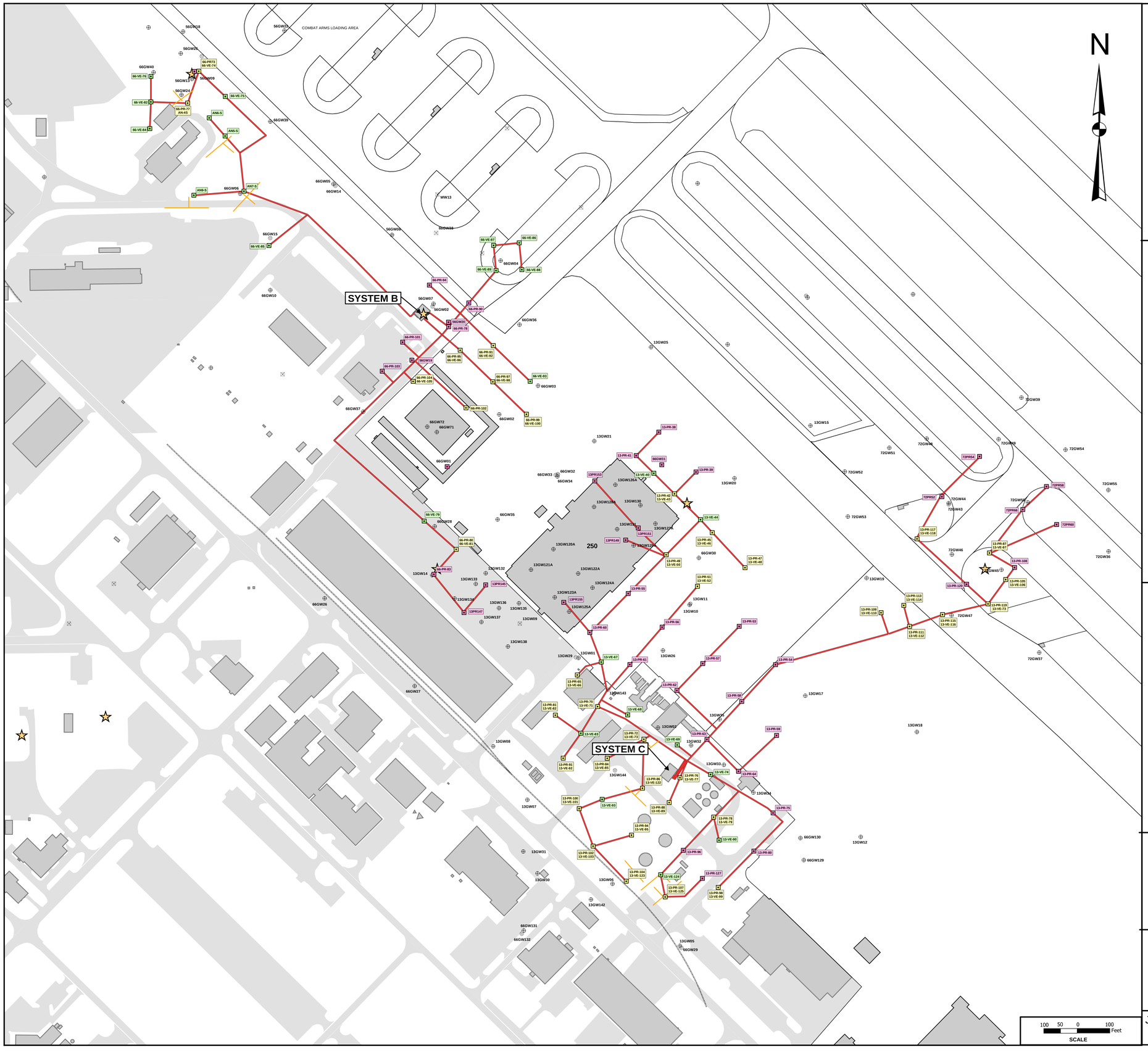
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 119 OF 919
CE14



MCAS CHERRY POINT REMEDIAL ACTION OPTIMIZATION PLAN

LEGEND

Well by Type

- Potable Well
- Industrial Well
- Recovery Well
- Surface Water
- T-I
- T-II
- T-III
- Unknown
- Railroad
- Small Tributaries
- Rivers and Creeks
- Building
- Point of Release

Remediation System

- Product Recovery Well
- Vapor Extraction Well
- Both Types of Wells
- SVE Horizontal Trenches
- Remediation System Piping

NOTES

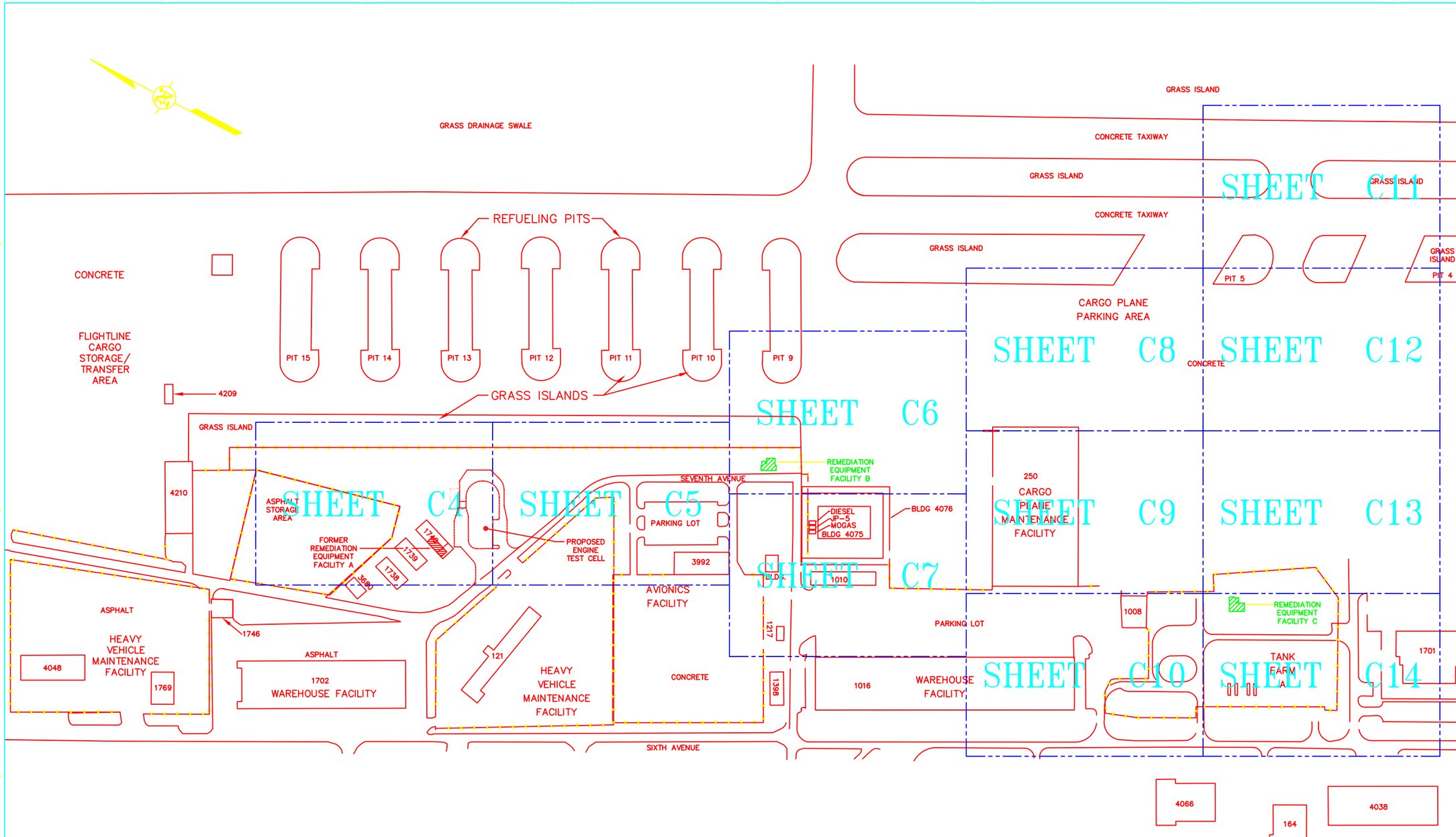
1. Remediation system location adapted from Building 4075 Pipeline Site Remediation "As-Built" drawing package by McLaren Hart.

CATLIN ENGINEERS and SCIENTISTS

SITE 4075 SITE MAP

FIGURE 2

Job No.:	Date:	Scale:	Drawn By:	Checked By:
203-065	NOV 2004	AS SHOWN	THW	JKB



GENERAL NOTES:

1. SPECIAL CARE WAS TAKEN WHEN WORKING NEAR THE FLIGHTLINE SECURITY FENCE TO AVOID DAMAGING THE FIBER OPTIC CABLE.
2. IN THE FLIGHTLINE AREAS, PARTIAL CONCRETE REMOVAL AND REPLACEMENT WAS PERFORMED WHEN THE WORK WAS WITHIN ONE-HALF OF THE SLAB WIDTH. THE MINIMUM SLAB REPLACEMENT WAS ONE-HALF OF THE SLAB WIDTH, OR 4 FEET LONG. OTHERWISE, THE ENTIRE SLAB WAS REPLACED.

NOTE:
THIS DRAWING IS FOR INFORMATIONAL PURPOSES ONLY AND IS NOT TO BE USED FOR CONSTRUCTION.

GRAPHIC SCALE
IF THIS DRAWING IS A REDUCTION, USE GRAPHIC SCALE
1" = 150'-0" 0 150 300 450 600

REFERENCE:
BACKGROUND MAPPING OBTAINED FROM RICHARD CATLIN ASSOCIATES INC. CONTRACT NO. N62470-93-4020 "BUILDING 4075 PIPELINE SITE REMEDIATION FINAL SUBMITTAL" MARINE CORPS AIR STATION, CHERRY POINT, N.C., FEBRUARY 28, 1996

REVISIONS

DESCRIPTION	DATE	APPROVED

CONTRACTOR: EFD
DESIGN
DRAWN
REVIEW
CHIEF ARCH / ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR
SEAL

McLaren Hart

A/E CONTRACT NO.
APPROVED
ACTIVITY - SATISFACTORY TO
APPROVED
DATE
DATE
FOR EFD FOR COMMANDER NAVFAC

DEPARTMENT OF THE NAVY
NAVAL STATION
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

BUILDING 4075 PIPELINE SITE REMEDIATION

"AS-BUILT" - INDEX SHEET

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 2 OF 38

I-1

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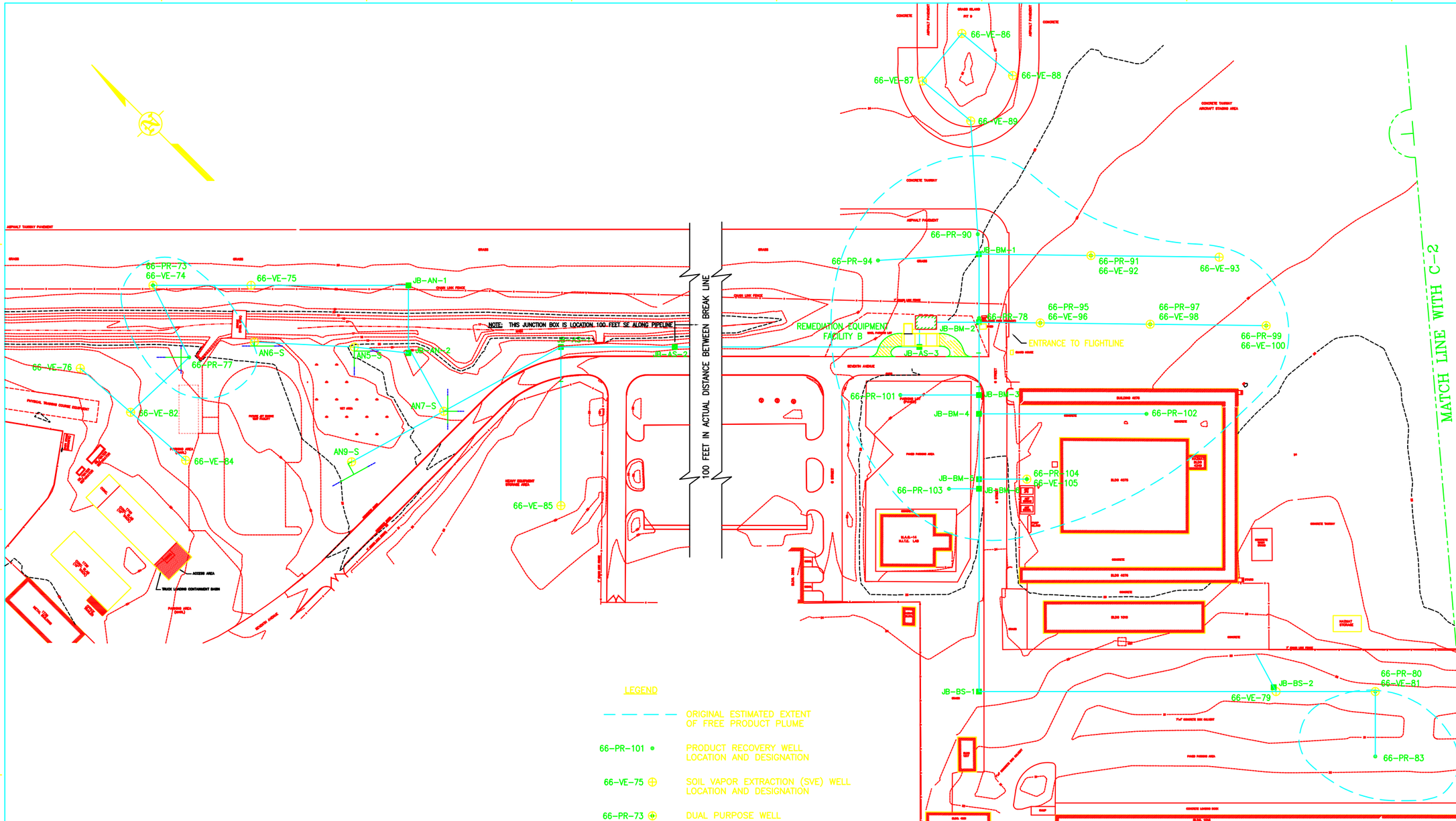

LEGEND

— — — —	ORIGINAL ESTIMATED EXTENT OF FREE PRODUCT PLUME
66-PR-101 •	PRODUCT RECOVERY WELL LOCATION AND DESIGNATION
66-VE-75 ⊕	SOIL VAPOR EXTRACTION (SVE) WELL LOCATION AND DESIGNATION
66-PR-73 ⊕ 66-VE-74	DUAL PURPOSE WELL LOCATION AND DESIGNATIONS
———	VAPOR TRENCH

			C11
		C8	C12
	C6	C9	C13
C4	C5	C7	C14
		C10	

S H E E T I N D E X

REFERENCE:
BACKGROUND MAPPING OBTAINED FROM RICHARD CATLIN ASSOCIATES INC., CONTRACT NO. N62470-93-4020, "BUILDING 4075 PIPELINE SITE REMEDIATION FINAL SUBMITTAL," MARINE CORPS AIR STATION, CHERRY POINT, N.C., FEBRUARY 28, 1996

GRAPHIC SCALE
IF THIS DRAWING IS A REDUCTION, USE GRAPHIC SCALE
1" = 60'-0" 0 60 120 180 240

REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVED

CONTRACTOR EFD
DESIGN
DESIGN
REVIEW
CHIEF ARCH./ ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

McLaren Hart

A/E CONTRACT NO.
APPROVED DATE
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APPROVED DATE
FOR EFD FOR COMMANDER SWFAC
SEAL

DEPARTMENT OF THE NAVY
NAVAL STATION
MARINE CORPS AIR STATION
ATLANTIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
NORFOLK, VIRGINIA
CHERRY POINT, NORTH CAROLINA
BUILDING 4075 PIPELINE SITE REMEDIATION
"AS-BUILT" - INSTALLATION PLAN, SHEET 1 OF 3

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 3 OF 38
C-1

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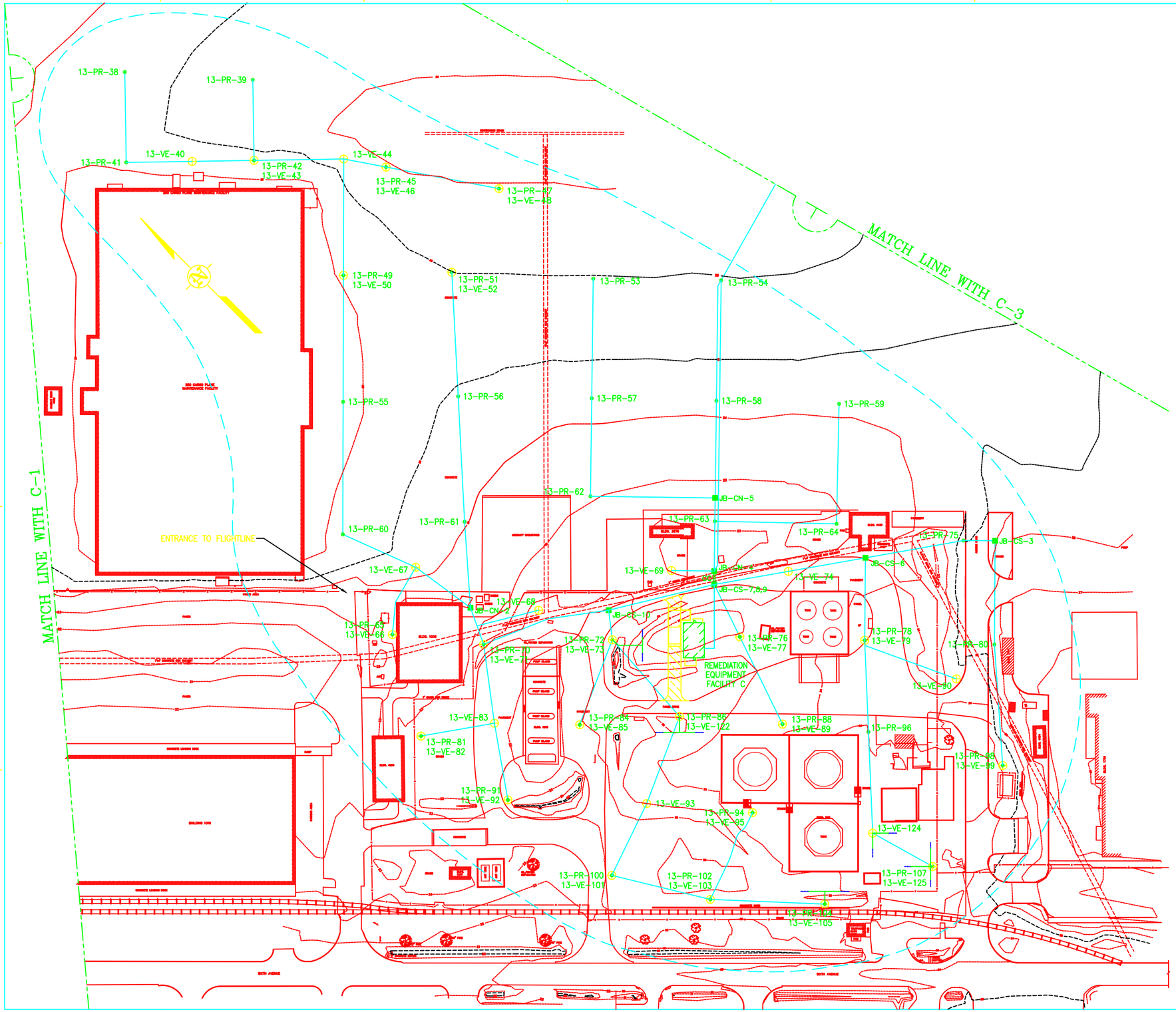
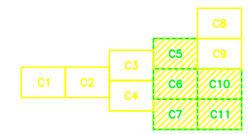


LEGEND

- ORIGINAL ESTIMATED EXTENT OF FREE PRODUCT PLUME
- 13-PR-38 PRODUCT RECOVERY WELL LOCATION AND DESIGNATION
- 13-VE-40 SOIL VAPOR EXTRACTION (SVE) WELL LOCATION AND DESIGNATION
- 13-PR-42 13-VE-43 DUAL PURPOSE WELL LOCATION AND DESIGNATIONS
- VAPOR TRENCH



SHEET INDEX

REFERENCE:
BACKGROUND MAPPING OBTAINED FROM
RICHARD CATLIN ASSOCIATES INC.
CONTRACT NO. N62470-93-4020
"BUILDING 4075 PIPELINE SITE REMEDIATION FINAL SUBMITTAL"
MARINE CORPS AIR STATION, CHERRY POINT, N.C.,
FEBRUARY 28, 1996

GRAPHIC SCALE
IF THIS DRAWING IS A REDUCTION, USE GRAPHIC SCALE
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1" = 60'-0"

REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVED

CONTRACTOR EFD
DESIGN
DESIGN
REVIEW
CHIEF ARCH./ ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

McLaren Hart

A/E CONTRACT NO.
APPROVED DATE
ACTIVITY - SATISFACTORY TO DATE
FOR EFD FOR COMMANDER NAVFAC
SEAL

DEPARTMENT OF THE NAVY
NAVAL STATION
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

BUILDING 4075 PIPELINE SITE REMEDIATION

"AS-BUILT" - INSTALLATION PLAN, SHEET 2 OF 3

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 4 OF 38

C-2

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LEGEND

— — — —	ORIGINAL ESTIMATED EXTENT OF FREE PRODUCT PLUME
13-PR-108 ●	PRODUCT RECOVERY WELL LOCATION AND DESIGNATION
13-PR-109 ⊕ 13-VE-110	DUAL PURPOSE WELL LOCATION AND DESIGNATIONS

SHEET INDEX

REFERENCE:
BACKGROUND MAPPING OBTAINED FROM
RICHARD CATLIN ASSOCIATES INC.
CONTRACT NO. N62470-93-4020
"BUILDING 4075 PIPELINE SITE REMEDIATION FINAL SUBMITTAL"
MARINE CORPS AIR STATION, CHERRY POINT, N.C.,
FEBRUARY 28, 1996

GRAPHIC SCALE
IF THIS DRAWING IS A REDUCTION, USE GRAPHIC SCALE
1" = 60'-0"
0 60 120 180 240

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

CONTRACTOR
EFD
DESIGN
DRAWN
REVIEW
CHIEF ARCH./ ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

McLaren Hart

A/E CONTRACT NO.
APPROVED DATE
ACTIVITY - SATISFACTORY TO
APPROVED DATE
FOR EFD FOR COMMANDER NAVFAC
SIGN.

DEPARTMENT OF THE NAVY
NAVAL STATION
MARINE CORPS AIR STATION
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
CHERRY POINT, NORTH CAROLINA

BUILDING 4075 PIPELINE SITE REMEDIATION

"AS-BUILT" - INSTALLATION PLAN, SHEET 3 OF 3

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO.
N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 5 OF 38
C-3

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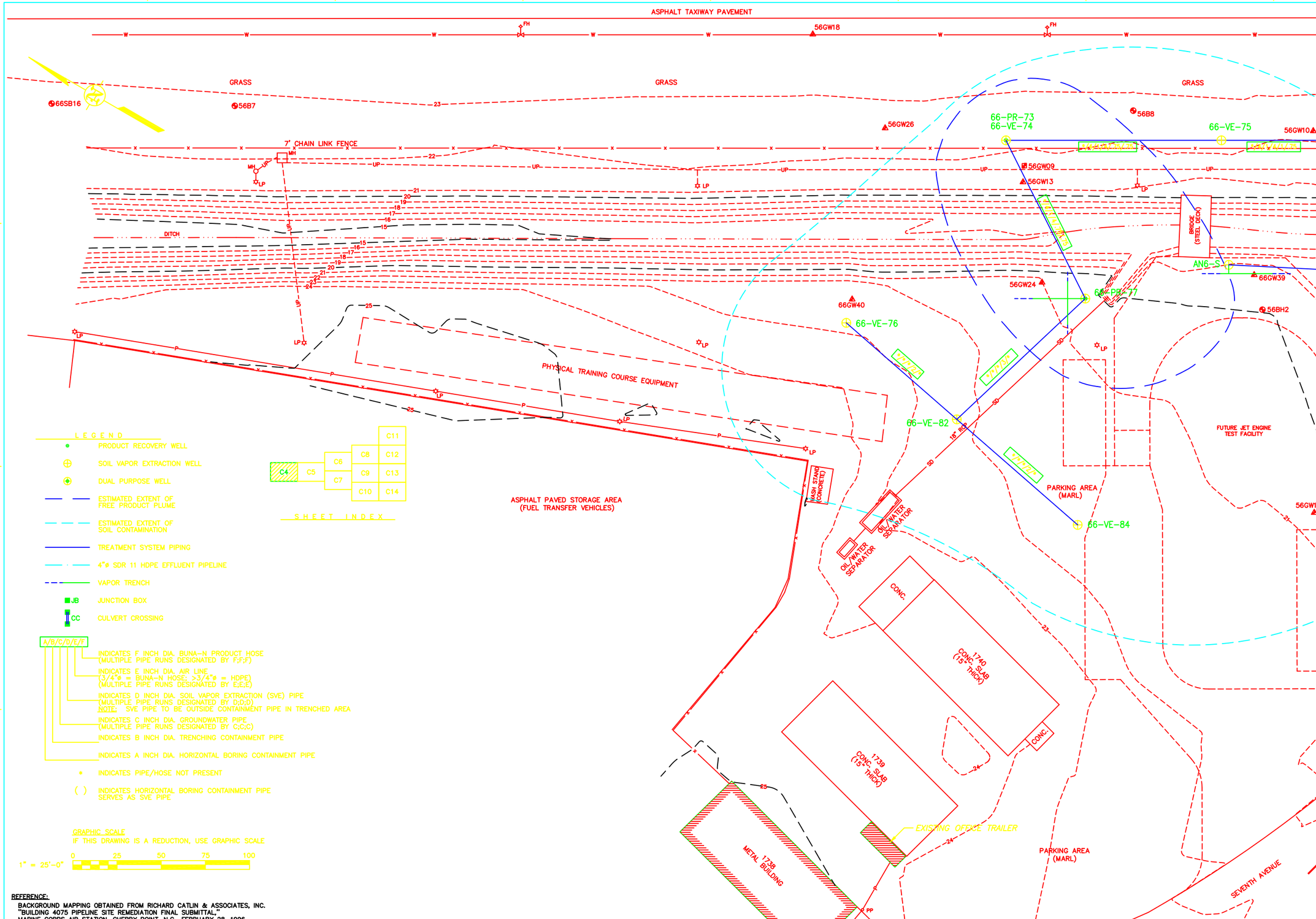

LEGEND

- PRODUCT RECOVERY WELL
- SOIL VAPOR EXTRACTION WELL
- DUAL PURPOSE WELL
- ESTIMATED EXTENT OF FREE PRODUCT PLUME
- ESTIMATED EXTENT OF SOIL CONTAMINATION
- TREATMENT SYSTEM PIPING
- 4"ø SDR 11 HDPE EFFLUENT PIPELINE
- VAPOR TRENCH
- JB — JUNCTION BOX
- CC — CULVERT CROSSING

A/B/C/D/E/F

- INDICATES F INCH DIA. BUNA-N PRODUCT HOSE (MULTIPLE PIPE RUNS DESIGNATED BY F;F;F)
- INDICATES E INCH DIA. AIR LINE (3/4"ø = BUNA-N HOSE; >3/4"ø = HDPE) (MULTIPLE PIPE RUNS DESIGNATED BY E;E;E)
- INDICATES D INCH DIA. SOIL VAPOR EXTRACTION (SVE) PIPE (MULTIPLE PIPE RUNS DESIGNATED BY D;D;D) NOTE: SVE PIPE TO BE OUTSIDE CONTAINMENT PIPE IN TRENCHED AREA
- INDICATES C INCH DIA. GROUNDWATER PIPE (MULTIPLE PIPE RUNS DESIGNATED BY C;C;C)
- INDICATES B INCH DIA. TRENCHING CONTAINMENT PIPE
- INDICATES A INCH DIA. HORIZONTAL BORING CONTAINMENT PIPE
- * INDICATES PIPE/HOSE NOT PRESENT
- ( ) INDICATES HORIZONTAL BORING CONTAINMENT PIPE SERVES AS SVE PIPE

SHEET INDEX

C4	C5	C6	C11
		C7	C8	C12
			C9	C13
			C10	C14

GRAPHIC SCALE
IF THIS DRAWING IS A REDUCTION, USE GRAPHIC SCALE
1" = 25'-0" 0 25 50 75 100

REFERENCE:
BACKGROUND MAPPING OBTAINED FROM RICHARD CATLIN & ASSOCIATES, INC. "BUILDING 4075 PIPELINE SITE REMEDIATION FINAL SUBMITTAL," MARINE CORPS AIR STATION, CHERRY POINT, N.C., FEBRUARY 28, 1996.

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REVISIONS

DESCRIPTION	DATE	APPROVED

CONTRACTOR / DESIGN ENGINEER / DESIGN MANAGER / CHIEF ARCH./ ENGR. / PROJECT MANAGER / FIRE PROTECTION / QUALITY CONTROL / BRANCH MANAGER / DESIGN DIRECTOR — EFD — SIGN. DATE

McLaren Hart

A/E CONTRACT NO. — DATE
APPROVED
ACTIVITY - SATISFACTORY TO — DATE
APPROVED
FOR EFD FOR COMMANDER PWD/AC — SIGN.

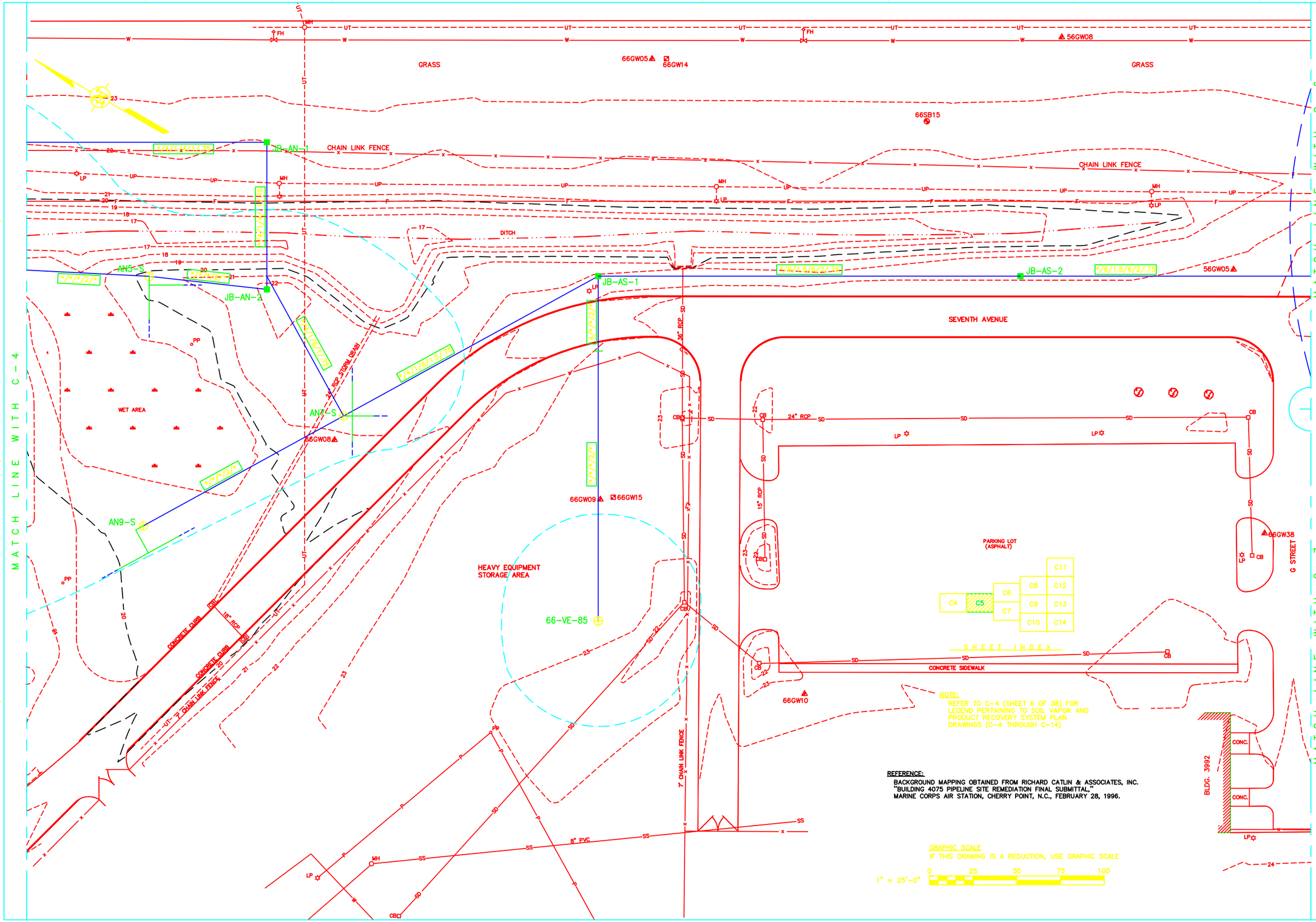
DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
NAVAL STATION
MARINE CORPS AIR STATION CHERRY POINT NORTH CAROLINA

BUILDING 4075 PIPELINE SITE REMEDIATION

"AS-BUILT" - SOIL VAPOR & PRODUCT RECOVERY PLAN, 1 OF 11

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO.
N62470-90-D-3033
NAVFAC DRAWING NO.
SHEET 6 OF 38

C-4



NOTE:
REFER TO C-4 (SHEET 6 OF 38) FOR LEGEND PERTAINING TO SOIL VAPOR AND PRODUCT RECOVERY SYSTEM PLAN DRAWINGS (C-4 THROUGH C-14)

REFERENCE:
BACKGROUND MAPPING OBTAINED FROM RICHARD CATLIN & ASSOCIATES, INC. "BUILDING 4075 PIPELINE SITE REMEDIATION FINAL SUBMITTAL," MARINE CORPS AIR STATION, CHERRY POINT, N.C., FEBRUARY 28, 1996.

GRAPHIC SCALE
IF THIS DRAWING IS A REDUCTION, USE GRAPHIC SCALE
1" = 25'-0" 0 25 50 75 100

REVISIONS

DESCRIPTION	DATE	APPROVED

CONTRACTOR
DESIGN
DRAWN
REVIEW
CHIEF ARCH/ ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

McLaren Hart

A/E CONTRACT NO.
APPROVED DATE
ACTIVITY - SATISFACTORY TO
APPROVED DATE
FOR EFD FOR COMMANDER NAVFAC
SEAL

DEPARTMENT OF THE NAVY
NAVAL STATION
NAVAL FACILITIES ENGINEERING COMMAND
NORFOLK, VIRGINIA
ATLANTIC DIVISION
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

BUILDING 4075 PIPELINE SITE REMEDIATION

"AS-BUILT" - SOIL VAPOR & PRODUCT RECOVERY PLAN, 2 OF 11

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO.
N62470-95-D-3033
NAVFAC DRAWING NO.
SHEET 7 OF 38

C-5

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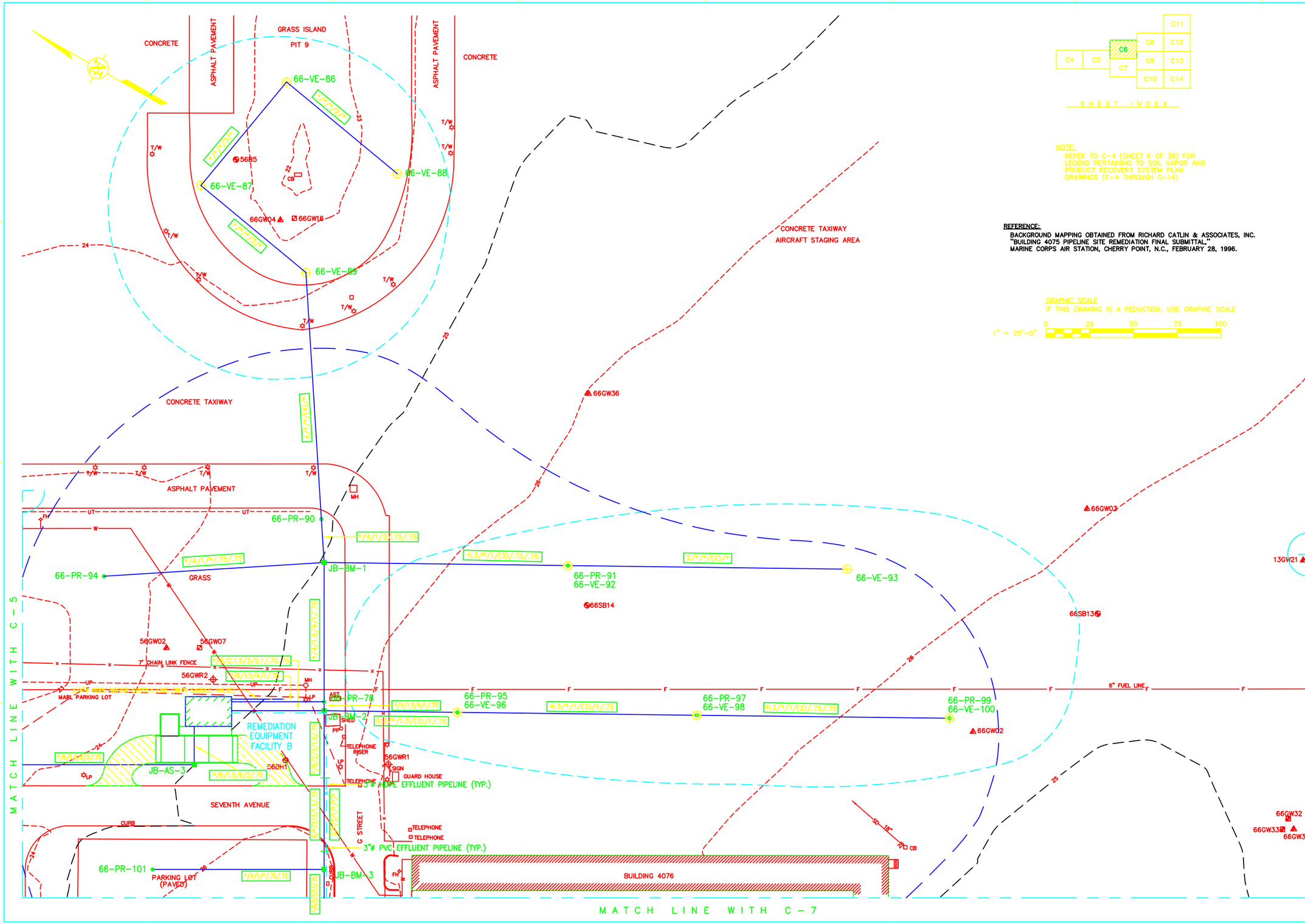


			C11
		C8	C12
C4	C5	C6	C9	C13
		C7	C10	C14

SHEET INDEX

NOTE:
REFER TO C-4 (SHEET 6 OF 38) FOR LEGEND PERTAINING TO SOIL VAPOR AND PRODUCT RECOVERY SYSTEM PLAN DRAWINGS (C-4 THROUGH C-14)

REFERENCE:
BACKGROUND MAPPING OBTAINED FROM RICHARD CATLIN & ASSOCIATES, INC. "BUILDING 4075 PIPELINE SITE REMEDIATION FINAL SUBMITTAL." MARINE CORPS AIR STATION, CHERRY POINT, N.C., FEBRUARY 28, 1996.

GRAPHIC SCALE
IF THIS DRAWING IS A REDUCTION, USE GRAPHIC SCALE
1" = 25'-0"
0 25 50 75 100

MATCH LINE WITH C-8

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

CONTRACTOR
DESIGN
DRAWN
REVIEW
CHIEF ARCH./ ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

EFD

McLaren Hart

A/E CONTRACT NO.
APPROVED DATE
ACTIVITY - SATISFACTORY TO
APPROVED DATE
FOR EFD FOR COMMENTS RWFAC
SEAL

DEPARTMENT OF THE NAVY
NAVAL STATION
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

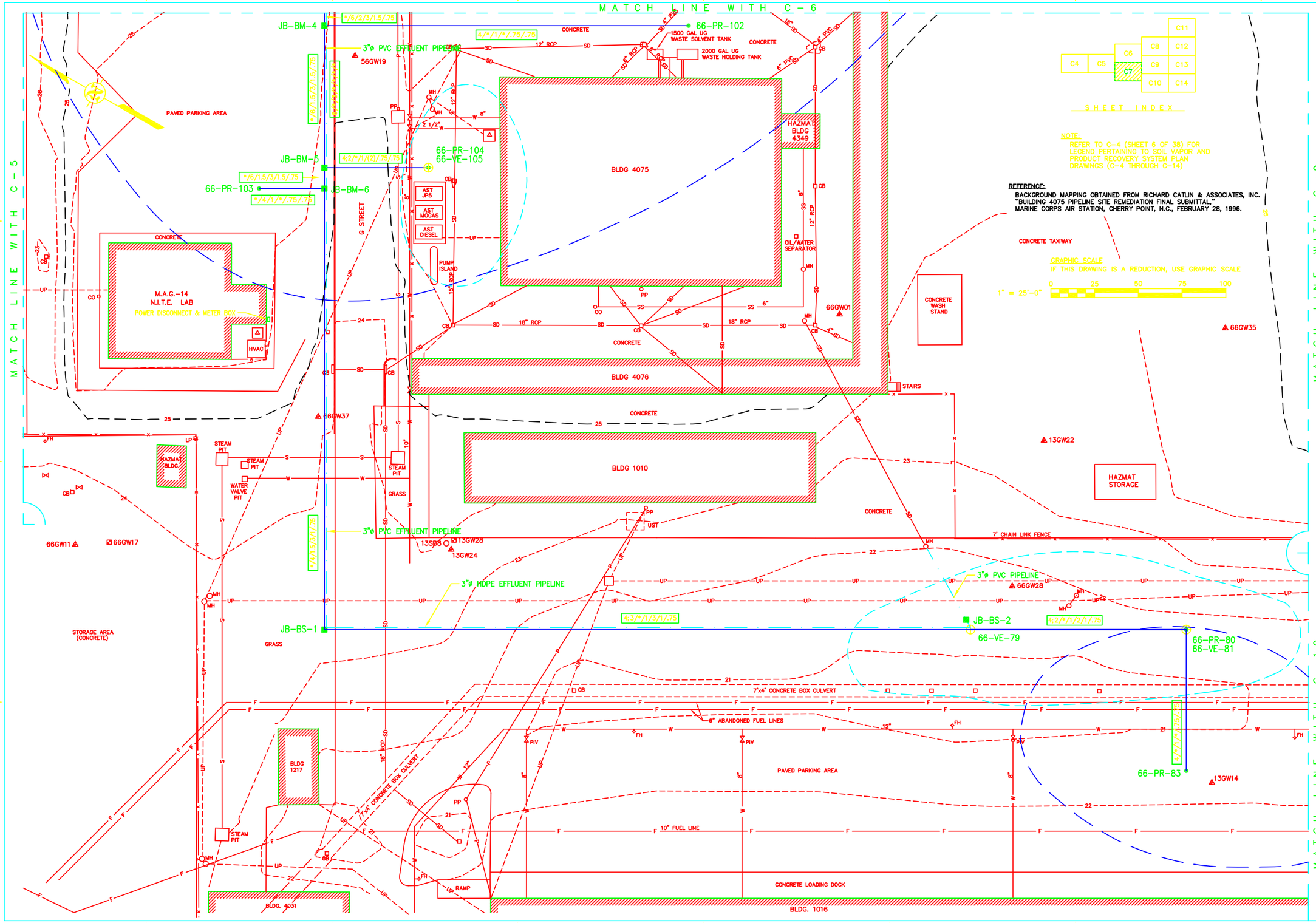
BUILDING 4075 PIPELINE SITE REMEDIATION

"AS-BUILT" - SOIL VAPOR & PRODUCT RECOVERY PLAN, 3 OF 11

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 8 OF 38

C-6

SNO G:\CAD\DWG\DA32\58320157 JAN23,2000 6:20PM PLOT: 1=25



REVISIONS

DESCRIPTION	DATE	APPROVED

CONTRACTOR | EFD | DESIGN | REVIEW | CHIEF ARCH./ ENGR. | PROJECT MANAGER | FIRE PROTECTION | QUALITY CONTROL | BRANCH MANAGER | DESIGN DIRECTOR | SYM.

McLaren Hart

A/E CONTRACT NO. | APPROVED | ACTIVITY – SATISFACTORY TO | APPROVED | FOR EFD FOR COMMANDER SWFAC | SEAL | DATE | DATE

DEPARTMENT OF THE NAVY
NAVAL STATION
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA

MARINE CORPS AIR STATION CHERRY POINT, NORTH CAROLINA

BUILDING 4075 PIPELINE SITE REMEDIATION

"AS-BUILT" – SOIL VAPOR & PRODUCT RECOVERY PLAN, 4 OF 11

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 9 OF 38
C-7

SKO G:\CAD\PWO\0832\98320158 MAR23,2000 6:20PM PLOT: 1=25

GRASS
GRASS
GRASS
13GW16
13GW16
25
26
ASPHALT PAVEMENT
ASPHALT PAVEMENT
T/W
CONCRETE TAXIWAY
CONCRETE TAXIWAY
26
25
24
POWER AND COMMUNICATION MANHOLES
MH
13GW20
66GW31
66SB12
DUAL VAULT
DUAL VAULT
CONTINUOUS DRAIN
CONCRETE BOX CULVERT
250 CARGO PLANE MAINTENANCE FACILITY
10" RCP
13-PR-38
13-PR-39
13-PR-41
13-PR-42
13-VE-40
13-VE-43
13-VE-44
13-PR-45
13-VE-46
13-PR-47
13-VE-48
4/*/1/*/1/.75
4/2/*/1/(2)/1/.75
6/3/*/1.5/(3)/1.5/.75
4/3/*/1/(3)/1/.75
4/3/*/1/(3)/1/.75/.75
4/4/1/2/(4)/2/.75
MATCH LINE WITH C-6
MATCH LINE WITH C-9
MATCH LINE WITH C-12

SHEET INDEX

					C11
				C8	C12
		C6			
C4	C5		C9		C13
		C7			
			C10		C14

NOTE:
REFER TO C-4 (SHEET 6 OF 38) FOR LEGEND PERTAINING TO SOIL VAPOR AND PRODUCT RECOVERY SYSTEM PLAN DRAWINGS (C-4 THROUGH C-14)

REFERENCE:
BACKGROUND MAPPING OBTAINED FROM RICHARD CATLIN & ASSOCIATES, INC. "BUILDING 4075 PIPELINE SITE REMEDIATION FINAL SUBMITTAL", MARINE CORPS AIR STATION, CHERRY POINT, N.C., FEBRUARY 28, 1996.

GRAPHIC SCALE
IF THIS DRAWING IS A REDUCTION, USE GRAPHIC SCALE
1" = 25'-0"
0 25 50 75 100

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

CONTRACTOR EFD
DESIGN
DRAWN
REVIEW
CHIEF ARCH./ ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

McLaren Hart

A/E CONTRACT NO. DATE
APPROVED
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FOR EFD FOR COMMANDER SWFAC
SEAL

DEPARTMENT OF THE NAVY
NAVAL STATION
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

BUILDING 4075 PIPELINE SITE REMEDIATION

"AS-BUILT" - SOIL VAPOR & PRODUCT RECOVERY PLAN, 5 OF 11

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 10 OF 38

C-8

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MATCH LINE WITH C-8

MATCH LINE WITH C-6

MATCH LINE WITH C-7

MATCH LINE WITH C-13

MATCH LINE WITH C-10

250 CARGO PLANE MAINTENANCE FACILITY

HAZMAT BLDG 4432

13B3
66GW30
66BB11
13-PR-51
13-VE-52
13-PR-49
13-VE-50
13-PR-53
13GW11
13GW10
13-PR-55
13-PR-56
13-PR-57
13B4
13GW26
13-PR-62
13-PR-61
13-PR-60
13-VE-67
DUAL VAULT
CONCRETE
5'x3' CONCRETE BOX CULVERT
AIRCRAFT WASHSTAND
WATER FAUCETS
SHEDS
TRANSFORMER
PAVED AREA
STEAM PIT
21" RCP
10" RCP

			C11
		C8	C12
	C6	C9	C13
C4	C5	C7	C10	C14

SHEET INDEX

NOTE:
REFER TO C-4 (SHEET 6 OF 38) FOR LEGEND PERTAINING TO SOIL VAPOR AND PRODUCT RECOVERY SYSTEM PLAN DRAWINGS (C-4 THROUGH C-14)

REFERENCE:
BACKGROUND MAPPING OBTAINED FROM RICHARD CATLIN & ASSOCIATES, INC. "BUILDING 4075 PIPELINE SITE REMEDIATION FINAL SUBMITTAL," MARINE CORPS AIR STATION, CHERRY POINT, N.C., FEBRUARY 28, 1996.

GRAPHIC SCALE
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1" = 25'-0" 0 25 50 75 100

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

CONTRACTOR EFD
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DESIGN
REVIEW
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PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

McLaren Hart

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NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

BUILDING 4075 PIPELINE SITE REMEDIATION

"AS-BUILT" – SOIL VAPOR & PRODUCT RECOVERY PLAN, 6 OF 11

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 11 OF 38

C-9

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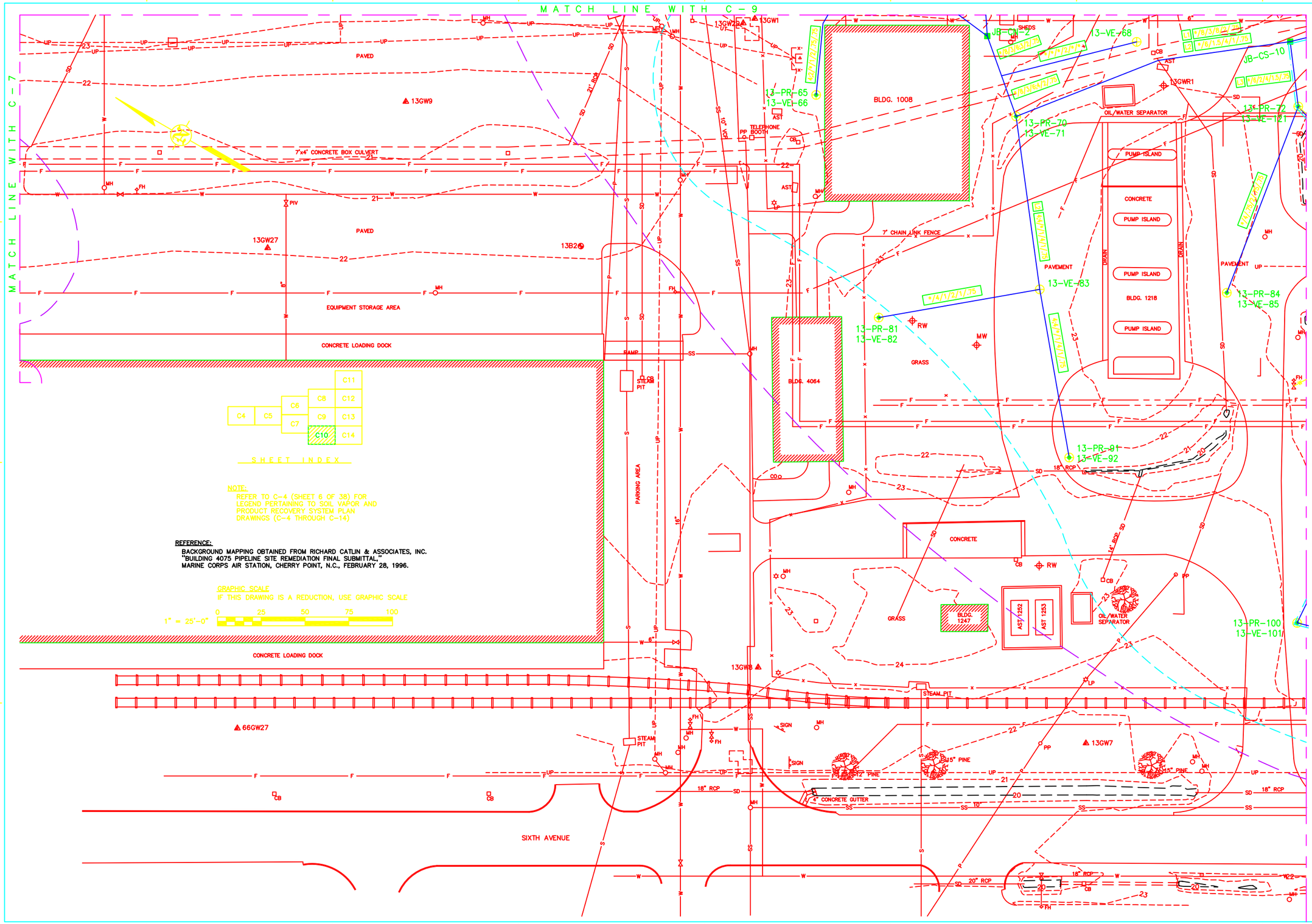

REVISIONS

DESCRIPTION	DATE	APPROVED

CONTRACTOR | EFD
DESIGN
DRAWN
REVIEW
CHIEF ARCH./ ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

McLaren Hart

A/E CONTRACT NO. | DATE
APPROVED
ACTIVITY - SATISFACTORY TO | DATE
APPROVED
FOR EFD FOR COMMANDER NAVFAC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL STATION ATLANTIC DIVISION NORFOLK, VIRGINIA
MARINE CORPS AIR STATION CHERRY POINT, NORTH CAROLINA

BUILDING 4075 PIPELINE SITE REMEDIATION

"AS-BUILT" - SOIL VAPOR & PRODUCT RECOVERY PLAN, 7 OF 11

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 12 OF 38
C-10

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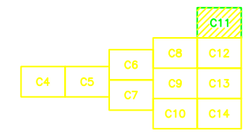


SHEET INDEX

NOTES:

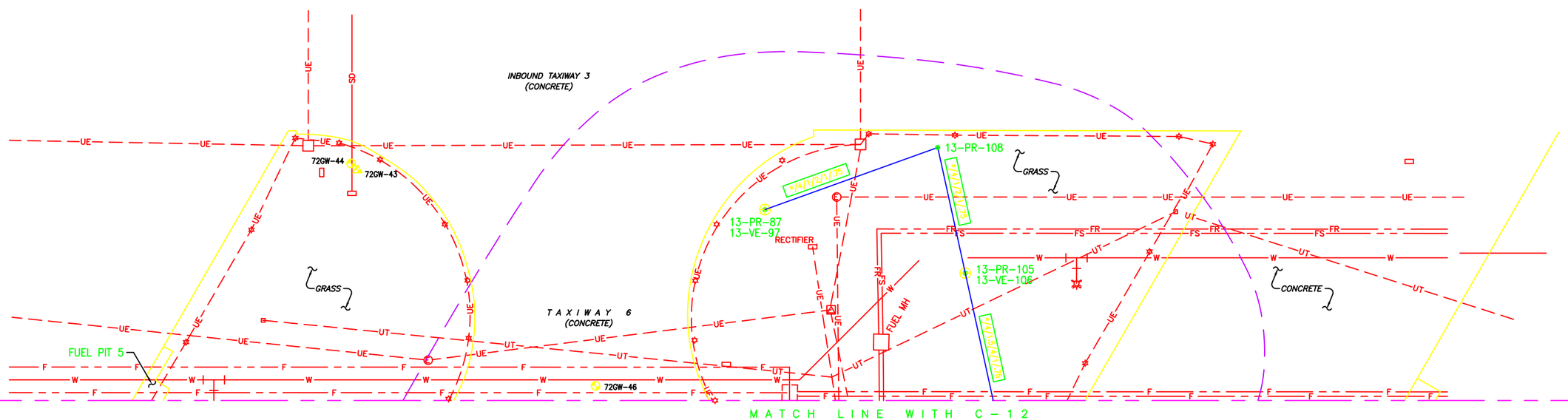
1. REFER TO C-4 (SHEET 6 OF 38) FOR LEGEND PERTAINING TO SOIL VAPOR AND PRODUCT RECOVERY SYSTEM PLAN DRAWINGS (C-4 THROUGH C-14)
2. INSTALL PRODUCT RECOVERY PUMP IN EXISTING MONITORING WELL (72GW-45).

REFERENCE:

BACKGROUND MAPPING OBTAINED FROM RICHARD CATLIN & ASSOCIATES, INC. "BUILDING 4075 PIPELINE SITE REMEDIATION FINAL SUBMITTAL," MARINE CORPS AIR STATION, CHERRY POINT, N.C., FEBRUARY 28, 1996.

GRAPHIC SCALE
IF THIS DRAWING IS A REDUCTION, USE GRAPHIC SCALE

1" = 25'-0" 0 25 50 75 100



REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

CONTRACTOR / EFD
DESIGN
DRAWN
REVIEW
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FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

McLaren Hart

A/E CONTRACT NO.
APPROVED DATE
ACTIVITY - SATISFACTORY TO DATE
APPROVED
FOR EFD FOR COMMANDER NAVFAC
SIGL

DEPARTMENT OF THE NAVY
NAVAL STATION
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

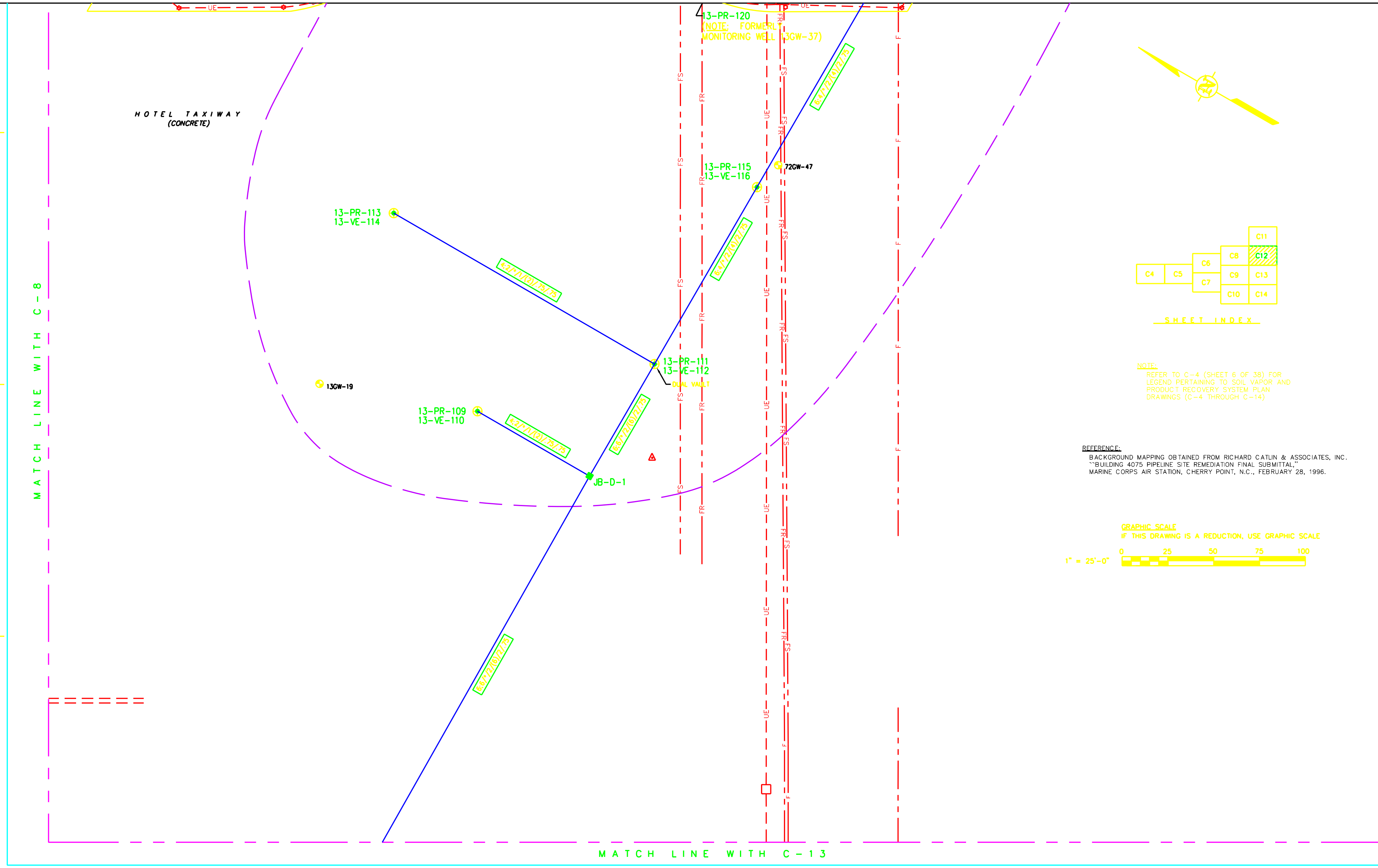
BUILDING 4075 PIPELINE SITE REMEDIATION

"AS-BUILT" - SOIL VAPOR & PRODUCT RECOVERY PLAN, 8 OF 11

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO.
N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 13 OF 38

C-11

SIG: G:\CAD\DWG\D832\S5320162 MAR22,2000 12:00AM PLOT: 1=25



NOTE:
REFER TO C-4 (SHEET 6 OF 38) FOR LEGEND PERTAINING TO SOIL VAPOR AND PRODUCT RECOVERY SYSTEM PLAN DRAWINGS (C-4 THROUGH C-14)

REFERENCE:
BACKGROUND MAPPING OBTAINED FROM RICHARD CATLIN & ASSOCIATES, INC. ``BUILDING 4075 PIPELINE SITE REMEDIATION FINAL SUBMITTAL,'' MARINE CORPS AIR STATION, CHERRY POINT, N.C., FEBRUARY 28, 1996.

GRAPHIC SCALE
IF THIS DRAWING IS A REDUCTION, USE GRAPHIC SCALE
0 25 50 75 100
1" = 25'-0"

REVISIONS
SYM. DESCRIPTION

CONTRACTOR EFD
DESIGN
DRAWN
REVIEW
CHIEF ARCH./ ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

McLaren Hart
A/E CONTRACT NO.
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SEAL

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NAVAL STATION NORFOLK, VIRGINIA
MARINE CORPS AIR STATION CHERRY POINT, NORTH CAROLINA
BUILDING 4075 PIPELINE
SITE REMEDIATION
"AS-BUILT" - SOIL VAPOR & PRODUCT RECOVERY PLAN, 9 OF 11

CODE ID. NO. ____	SIZE D
SCALE: AS NOTED	
EFD NO.	
STA. PROJ. NO. 945832	
SPEC. NO.	
CONSTR. CONTR. NO. N62470-93-D-3033	
NAVFAC DRAWING NO.	
SHEET 14 OF 38	

C-12

1 2 3 4 5 6 7 8
A B C D

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MATCH LINE WITH C-9

MATCH LINE WITH C-6

MATCH LINE WITH C-11

13B5

13B6

13B7

13GW17

13GW12

13GW35

13GW33

13GW32

13GW2

6" FUEL LINE (ABANDONED)

6" FUEL LINE

13-PR-54

42"ø ROUND CONCRETE VAULT

13-PR-58

13-PR-59

13-PR-63

13-PR-64

13-PR-75

JB-CN-5

JB-CN-4

JB-CS-6

JB-CS-7,8,9

JB-CS-3

13-VE-69

13-VE-74

CONTINUOUS DRAIN

FUEL VALVE

BLDG. 3976

BLDG. 4430

PAVEMENT

CONCRETE PAD

CONCRETE

GRASS

SHED

AST

MH

PAD

POWER PANEL

7" CHAIN LINK FENCE

PAVED ACCESS ROAD

7'x4' CONCRETE BOX CULVERT

8.5'x5.5' CONC. BOX CULVERT

ACCESS ROAD

30" RCP

2-30" RCP

2-24" RCP

PUMP

CB

FH

REFER TO "PIPE DESIGNATION CHART" ON THIS SHEET FOR PIPELINE CONFIGURATIONS (A, B, C)

SHEET INDEX

				C11
		C8		C12
C4	C5	C6	C9	C13
		C7	C10	C14

NOTE:
REFER TO C-4 (SHEET 6 OF 38) FOR LEGEND PERTAINING TO SOIL VAPOR AND PRODUCT RECOVERY SYSTEM PLAN DRAWINGS (C-4 THROUGH C-14)

REFERENCE:
BACKGROUND MAPPING OBTAINED FROM RICHARD CATLIN & ASSOCIATES, INC. "BUILDING 4075 PIPELINE SITE REMEDIATION FINAL SUBMITTAL," MARINE CORPS AIR STATION, CHERRY POINT, N.C., FEBRUARY 28, 1996.

GRAPHIC SCALE
IF THIS DRAWING IS A REDUCTION, USE GRAPHIC SCALE
1" = 25'-0"
0 25 50 75 100

PIPE CONFIGURATION CHART

A	L1	*/8/3/8/2/.75
	L2	*/6/1.5/4/1/.75
	L3	*/6/2/4/1.5/.75
B	L4	*/6/2/6/2/.75
	L5	*/6/2/*/1.5/.75
C	L6	*/6/1.5/6/1.5/.75

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

EFD
CONTRACTOR
DESIGN
DRAWN
REVIEW
CHIEF ARCH./ ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

McLaren Hart

A/E CONTRACT NO.
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SIGN.

DEPARTMENT OF THE NAVY
NAVAL STATION
ATLANTIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

BUILDING 4075 PIPELINE SITE REMEDIATION

"AS-BUILT" - SOIL VAPOR & PRODUCT RECOVERY PLAN, 10 OF 11

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 15 OF 38

C-13

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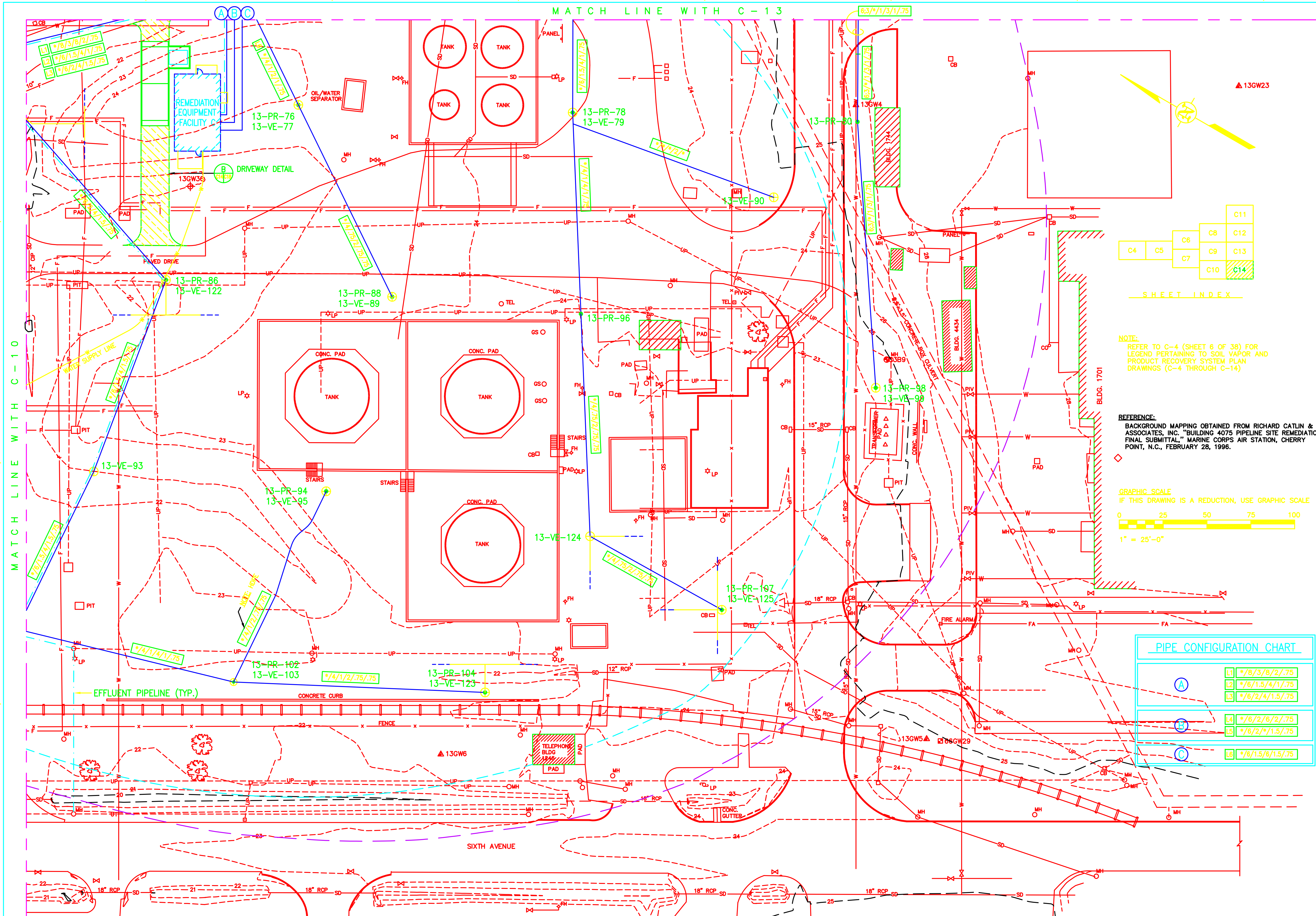

NOTE:
REFER TO C-4 (SHEET 6 OF 38) FOR LEGEND PERTAINING TO SOIL VAPOR AND PRODUCT RECOVERY SYSTEM PLAN DRAWINGS (C-4 THROUGH C-14)

REFERENCE:
BACKGROUND MAPPING OBTAINED FROM RICHARD CATLIN & ASSOCIATES, INC. "BUILDING 4075 PIPELINE SITE REMEDIATION FINAL SUBMITTAL," MARINE CORPS AIR STATION, CHERRY POINT, N.C., FEBRUARY 28, 1996.

GRAPHIC SCALE
IF THIS DRAWING IS A REDUCTION, USE GRAPHIC SCALE
0 25 50 75 100
1" = 25'-0"

PIPE CONFIGURATION CHART

Configuration	Line	Specification
A	L1	*/8/3/8/2/.75
	L2	*/6/1.5/4/1/.75
	L3	*/6/2/4/1.5/.75
B	L4	*/6/2/6/2/.75
	L5	*/6/2/*/1.5/.75
C	L6	*/6/1.5/6/1.5/.75

REVISIONS
SYM. DESCRIPTION DATE APPROVED

EFD: CONTRACTOR, DESIGN, DRAWN, REVIEW, CHIEF ARCH./ ENGR., PROJECT MANAGER, FIRE PROTECTION, QUALITY CONTROL, BRANCH MANAGER, DESIGN DIRECTOR

McLaren Hart
A/E CONTRACT NO.
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SEAL

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NAVAL STATION NORFOLK, VIRGINIA
MARINE CORPS AIR STATION CHERRY POINT, NORTH CAROLINA

BUILDING 4075 PIPELINE SITE REMEDIATION

"AS-BUILT" - SOIL VAPOR & PRODUCT RECOVERY PLAN, 11 OF 11

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 16 OF 38
C-14

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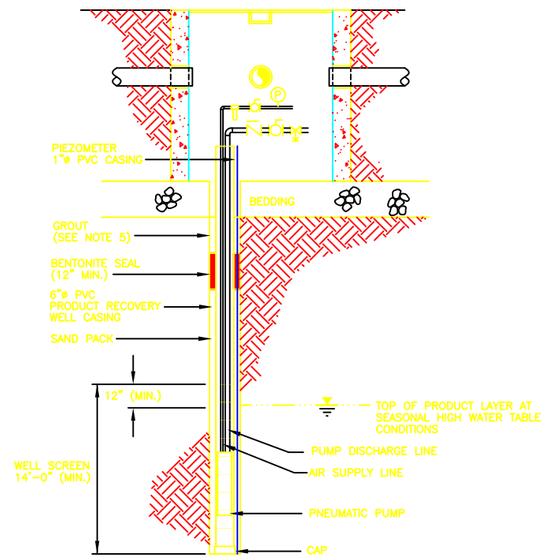
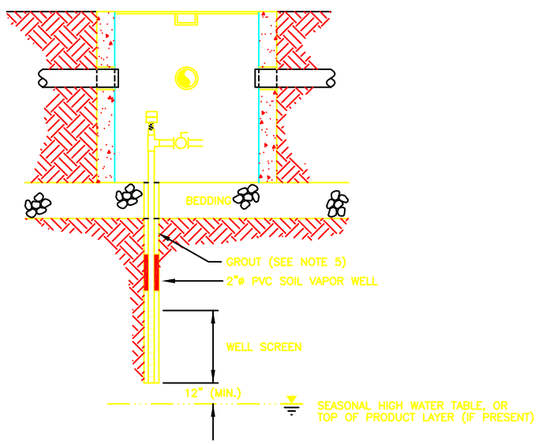


A (C1 C15) TYPICAL DUAL PHASE PRODUCT RECOVERY WELL (P)

N.T.S.

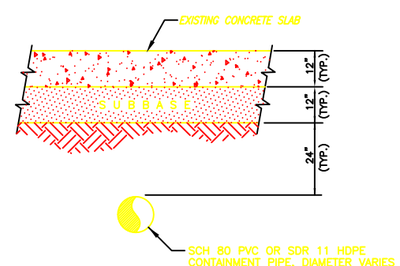
LEGEND

- BALL VALVE
- CHECK VALVE
- MOISTURE FILTER
- PRESSURE REGULATOR
- SAMPLE PORT
- QUICK DISCONNECT COUPLING
- THREADED COUPLING



B (C1 C15) TYPICAL SOIL VAPOR EXTRACTION WELL (S)

N.T.S.



NOTES:

1. CONTAINMENT PIPE CARRIES ONE OR MORE OF THE FOLLOWING LINES:

   AIR SUPPLY LINE,
   PUMP DISCHARGE LINE,
   SOIL VAPOR EXTRACTION LINE
   PRODUCT HOSE

2. CONTAINMENT PIPE WAS BROUGHT TO WITHIN 24" BELOW THE GROUND SURFACE AT THE VAULTS.

C (C1 C15) HORIZONTAL BORING DETAIL FLIGHTLINE AREA

N.T.S.

NOTES:

1. ALL VAULT BOXES HAVE HYDRAULICALLY-ASSISTED LIDS.
2. REFER TO SHEETS C-17 & C-18 FOR VAULT BOX DESIGN AND DIMENSIONS.
3. VAULT BOXES WITHIN THE FLIGHTLINE WERE STAMPED "100 KIP MAXIMUM LOAD".
4. AIRCRAFT MOORINGS WERE REPLACED IN KIND AT SIMILAR LOCATION AND ORIENTATION.
5. TOP OF GROUT PLUG FOR WELLS WERE SET 4 FEET BELOW ORIGINAL GROUND SURFACE.

DRAWING NOT TO SCALE

REVISIONS

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CONTRACTOR EFD
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PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

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NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

BUILDING 4075 PIPELINE
SITE REMEDIATION

"AS-BUILT" - SOIL VAPOR AND PRODUCT RECOVERY SYSTEM DETAILS

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 17 OF 38
C-15

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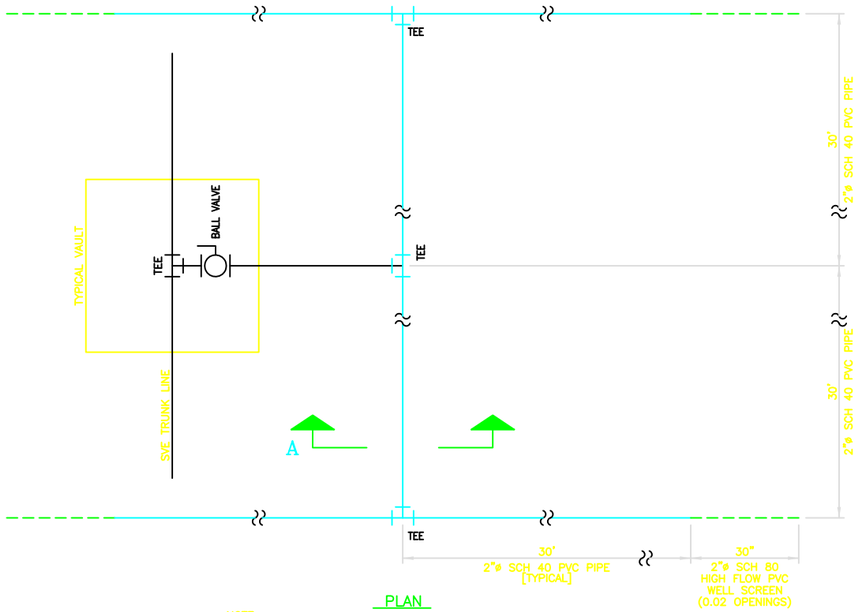
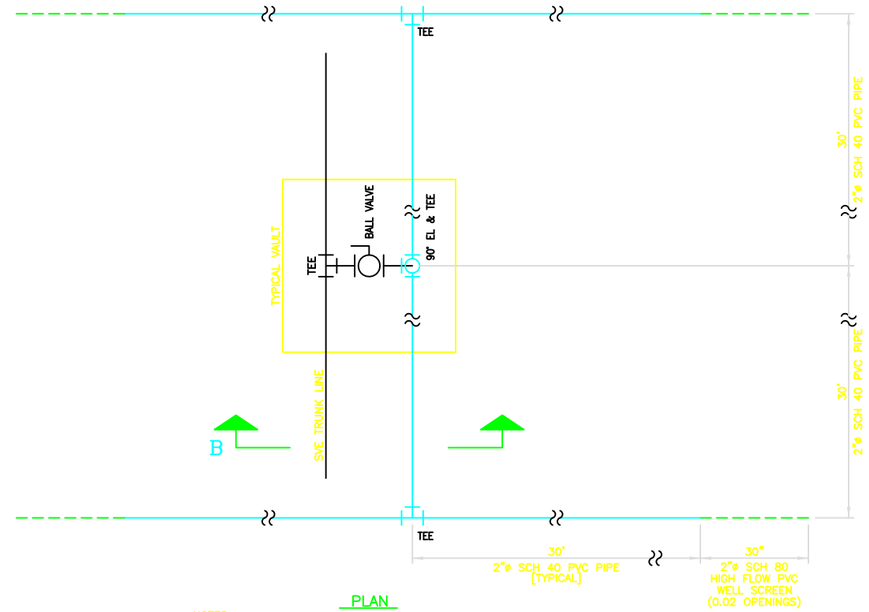


PLAN

NOTE:

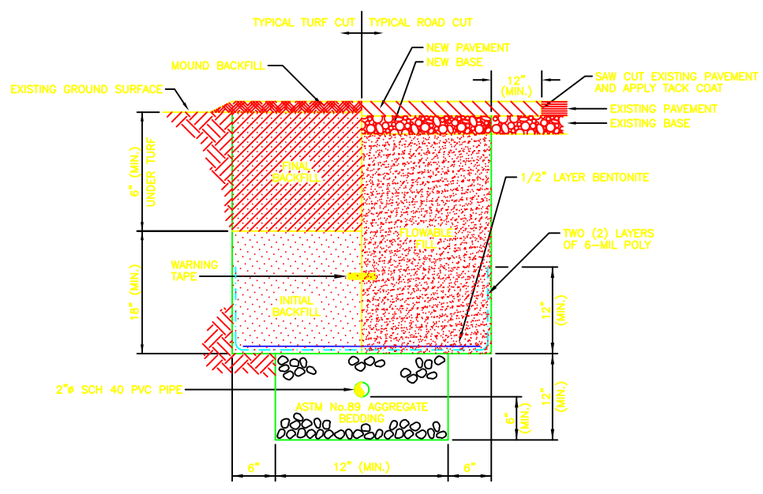
TWO COLLECTION LINES AND WELL SCREENS MAY BE USED WHERE FOUR COLLECTIONS LINES AND WELL SCREENS CAN NOT BE INSTALLED DUE TO FIELD CONDITIONS.



PLAN

NOTES:

1. TWO COLLECTION LINES AND WELL SCREENS MAY BE USED WHERE FOUR COLLECTIONS LINES AND WELL SCREENS CAN NOT BE INSTALLED DUE TO FIELD CONDITIONS.
2. SVE TRUNK AND COLLECTION LINES OFFSET FOR VISUAL PURPOSES.



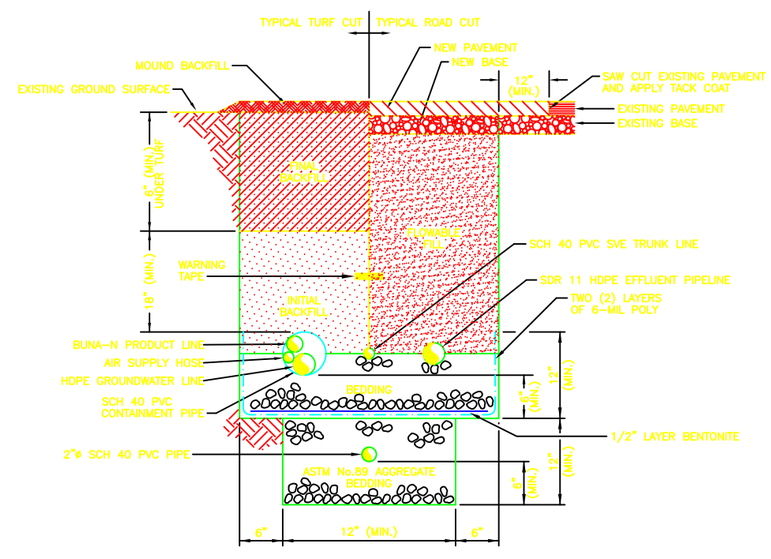
ELEVATION

TYPE A SVE TRENCH

N.T.S.

NOTE:

NUMBER OF UTILITY LINES AND LINE DIAMETERS VARY. MAINTAIN MINIMUM CLEARANCE BETWEEN UTILITIES AND TRENCH SIDE WALLS. SEE SPECIFICATION 02510 FOR MINIMUM SEPARATION FROM EXISTING UTILITIES.



NOTE:

ALLOW A MINIMUM OF 6 INCHES BETWEEN EACH PIPE RUN.

TYPE B SVE TRENCH

N.T.S.

NOTE:

NUMBER OF UTILITY LINES AND LINE DIAMETERS VARY. MAINTAIN MINIMUM CLEARANCE BETWEEN UTILITIES AND TRENCH SIDE WALLS. SEE SPECIFICATION 02510 FOR MINIMUM SEPARATION FROM EXISTING UTILITIES.

DRAWING NOT TO SCALE

REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVED

CONTRACTOR EFD
DESIGN
DRAWN
REVIEW
CHIEF ARCH./ ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

McLaren Hart

A/E CONTRACT NO.
APPROVED
ACTIVITY – SATISFACTORY TO DATE
APPROVED DATE
FOR EFD FOR COMMANDER NAVFAC
SEAL

NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
DEPARTMENT OF THE NAVY
NAVAL STATION
MARINE CORPS AIR STATION CHERRY POINT, NORTH CAROLINA

BUILDING 4075 PIPELINE SITE REMEDIATION

"AS-BUILT" – SOIL VAPOR EXTRACTION TRENCH DETAILS

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 18 OF 38

C-16

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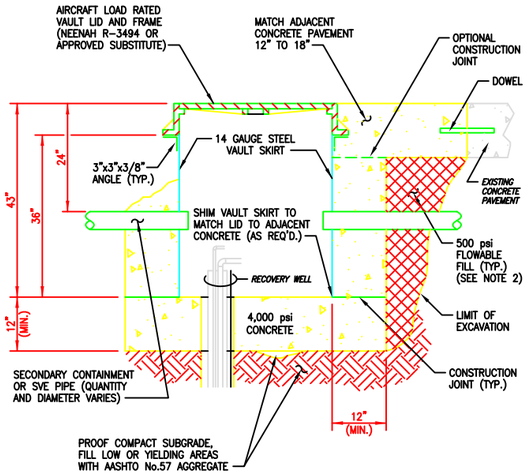
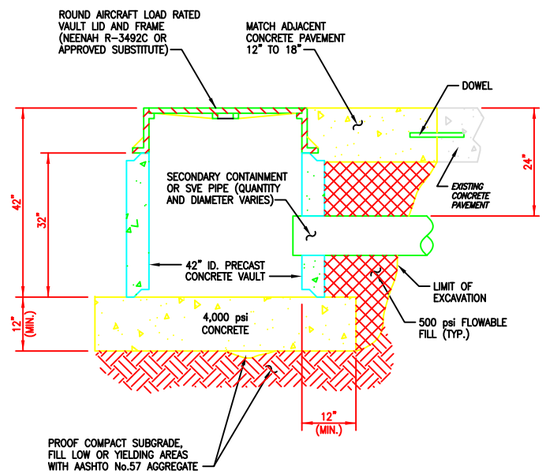
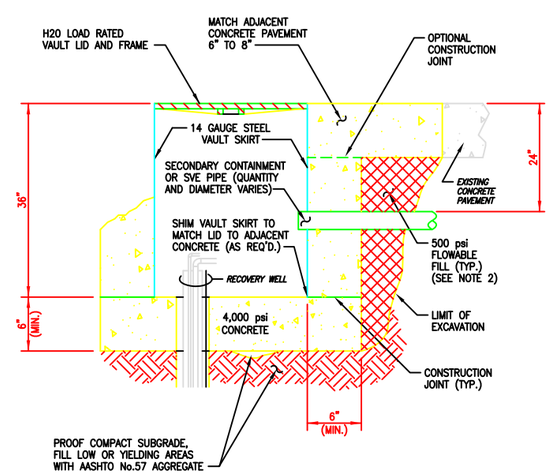


ELEVATION



ELEVATION



ELEVATION

A C1 C17 AIRCRAFT LOAD RATED VAULT

NOT TO SCALE

TYPE A
58" x 34" OPENING

TYPE B
30" x 30" OPENING

NOTES:
1. VAULT LIDS BEAR STAMP OF LOAD RATING.
2. ALL BACKFILL IN PAVED AREAS WAS 500 psi FLOWABLE FILL. CONCRETE MAY HAVE BEEN USED IN LIEU OF FLOWABLE FILL.
3. VAULT SKIRT FIELD CUT TO ACCEPT PIPES. ANNULUS FORMED BETWEEN PIPE(S) AND VAULT SKIRT TO PLACE CONCRETE.

TYPE C
42" INSIDE DIAMETER

NOTES:
1. VAULT LIDS BEAR STAMP OF LOAD RATING.
2. VAULT FIELD DRILLED TO ACCEPT PIPES. ANNULUS FORMED BETWEEN PIPE(S) AND VAULT TO PLACE CONCRETE.

B C1 C17 H20 LOAD RATED VAULT

NOT TO SCALE

TYPE D
60" x 36" OPENING

TYPE E
36" x 36" OPENING

NOTES:
1. ALL BACKFILL IN PAVED AREAS WAS 500 psi FLOWABLE FILL. CONCRETE MAY HAVE BEEN USED IN LIEU OF FLOWABLE FILL.
2. VAULT SKIRT FIELD CUT TO ACCEPT PIPES. ANNULUS FORMED BETWEEN PIPE(S) AND VAULT SKIRT TO PLACE CONCRETE.

DRAWING NOT TO SCALE

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

CONTRACTOR
EFD
DESIGN MANAGER
CHIEF ARCH./ ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

McLaren Hart

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APPROVED DATE
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SEAL

DEPARTMENT OF THE NAVY
NAVAL STATION
ATLANTIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA
BUILDING 4075 PIPELINE SITE REMEDIATION
"AS-BUILT" - FLIGHTLINE VAULT BOX DETAILS

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO.
N62470-99-B-D-3033
NAVFAC DRAWING NO.
SHEET 19 OF 38
C-17

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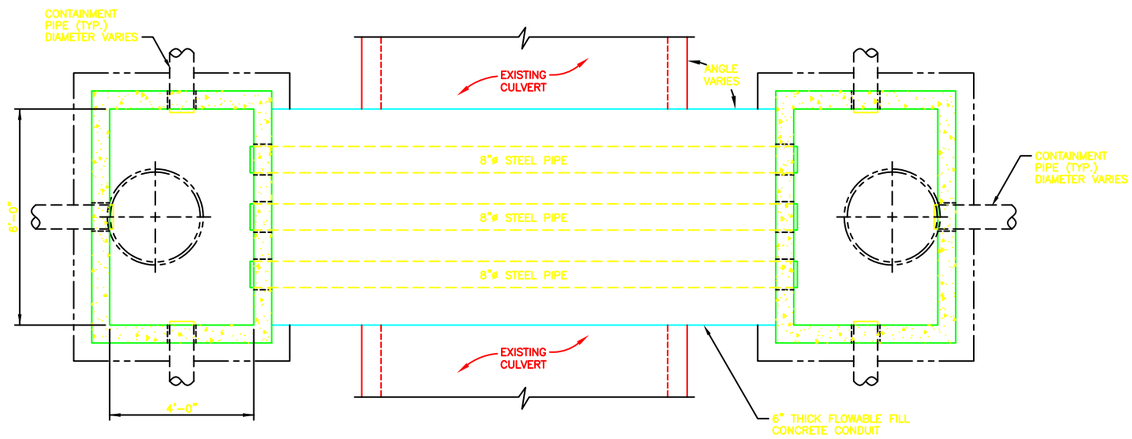
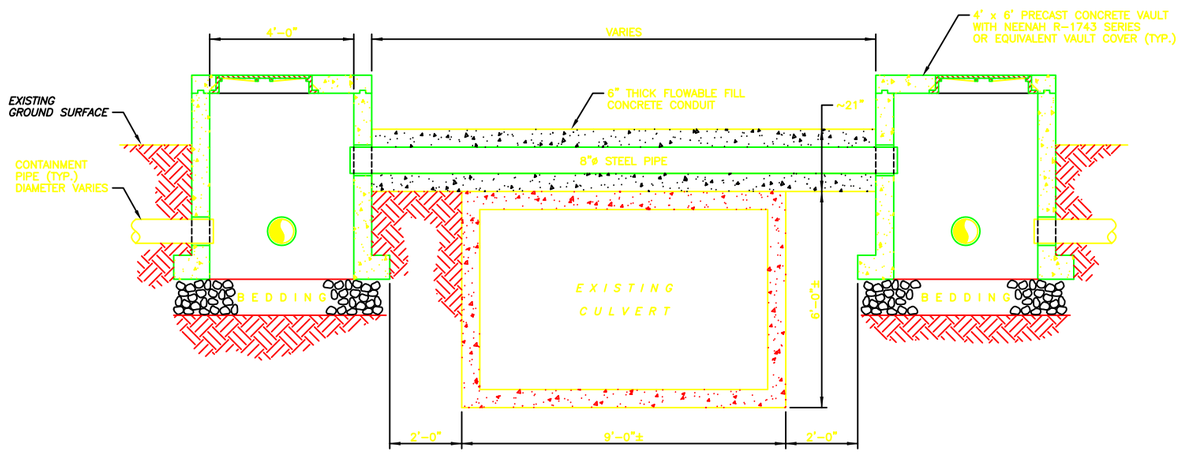


PLAN

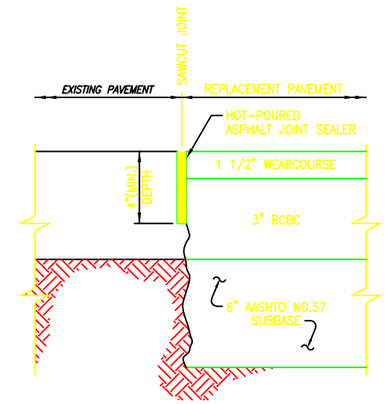


ELEVATION

A C13 C18 PIPE CROSSING CULVERT

SCALE: 1/2" = 1'-0"

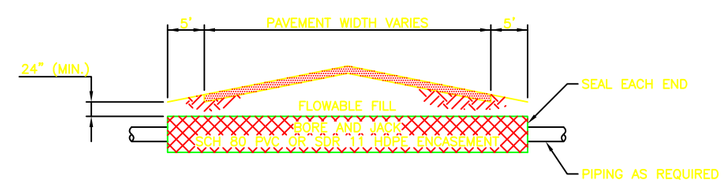
NOTE:
THIS DETAIL WAS UTILIZED WHEN CROSSING ANY EXISTING FACILITY WHICH COULD NOT BE PASSED OVER OR UNDER BY THE PIPING SYSTEM.



B C4 C18 DRIVEWAY DETAIL

NOT TO SCALE

NOTE:
THICKNESS OF BCBC LAYER WAS ADJUSTED UP OR DOWN TO MATCH EXISTING PAVEMENT THICKNESS.



TYPICAL ROAD CROSSING DETAIL

NOT TO SCALE

GRAPHIC SCALE
IF THIS DRAWING IS A REDUCTION, USE GRAPHIC SCALE
1/2" = 1'-0" 0 2 4 6 8

REVISIONS

DESCRIPTION	DATE	APPROVED

CONTRACTOR / EFD / DESIGN / REVIEW / CHIEF ARCH./ ENGR. / PROJECT MANAGER / FIRE PROTECTION / QUALITY CONTROL / BRANCH MANAGER / DESIGN DIRECTOR / FINAL

McLaren Hart

A/E CONTRACT NO.
APPROVED
ACTIVITY – SATISFACTORY TO
APPROVED
FOR EFD FOR COMMANDER NAVFAC
SEAL

DEPARTMENT OF THE NAVY
NAVAL STATION
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA
BUILDING 4075 PIPELINE SITE REMEDIATION
"AS-BUILT" – NON-FLIGHTLINE CIVIL DETAILS

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 20 OF 38
C-18

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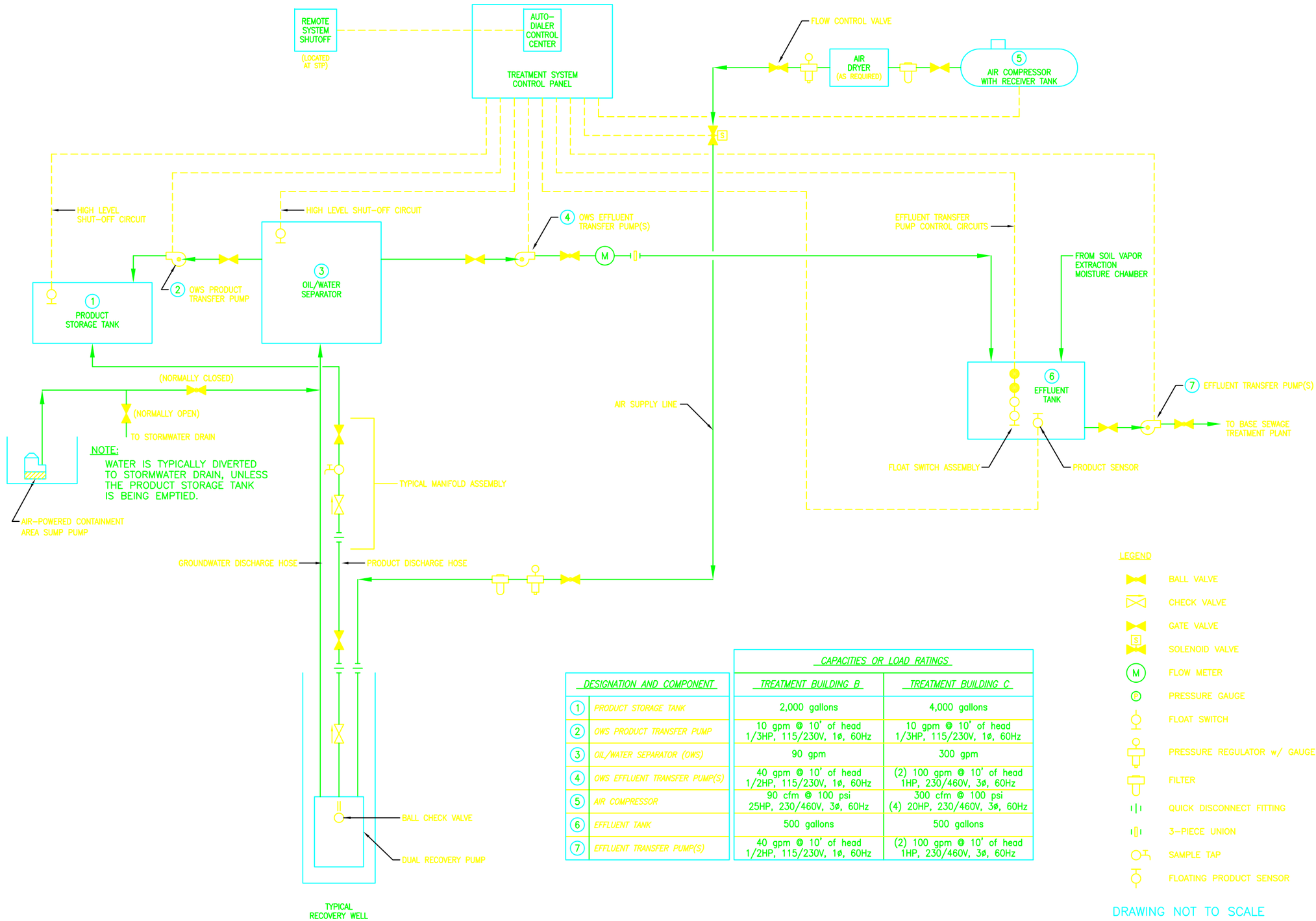

DESIGNATION AND COMPONENT		CAPACITIES OR LOAD RATINGS	
		TREATMENT BUILDING B	TREATMENT BUILDING C
1	PRODUCT STORAGE TANK	2,000 gallons	4,000 gallons
2	OWS PRODUCT TRANSFER PUMP	10 gpm @ 10' of head 1/3HP, 115/230V, 1ø, 60Hz	10 gpm @ 10' of head 1/3HP, 115/230V, 1ø, 60Hz
3	OIL/WATER SEPARATOR (OWS)	90 gpm	300 gpm
4	OWS EFFLUENT TRANSFER PUMP(S)	40 gpm @ 10' of head 1/2HP, 115/230V, 1ø, 60Hz	(2) 100 gpm @ 10' of head 1HP, 230/460V, 3ø, 60Hz
5	AIR COMPRESSOR	90 cfm @ 100 psi 25HP, 230/460V, 3ø, 60Hz	300 cfm @ 100 psi (4) 20HP, 230/460V, 3ø, 60Hz
6	EFFLUENT TANK	500 gallons	500 gallons
7	EFFLUENT TRANSFER PUMP(S)	40 gpm @ 10' of head 1/2HP, 115/230V, 1ø, 60Hz	(2) 100 gpm @ 10' of head 1HP, 230/460V, 3ø, 60Hz

LEGEND

- BALL VALVE
- CHECK VALVE
- GATE VALVE
- SOLENOID VALVE
- FLOW METER
- PRESSURE GAUGE
- FLOAT SWITCH
- PRESSURE REGULATOR w/ GAUGE
- FILTER
- QUICK DISCONNECT FITTING
- 3-PIECE UNION
- SAMPLE TAP
- FLOATING PRODUCT SENSOR

DRAWING NOT TO SCALE

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

CONTRACTOR EFD
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DRAWN
REVIEW
CHIEF ARCH./ ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

McLaren Hart

A/E CONTRACT NO. DATE
APPROVED
ACTIVITY - SATISFACTORY TO DATE
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FOR EFD FOR COMMANDER NAVFAC
SIGN.

DEPARTMENT OF THE NAVY
NAVAL STATION
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

BUILDING 4075 PIPELINE SITE REMEDIATION

"AS-BUILT" - TREATMENT SYSTEM SCHEMATIC

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO.
N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 21 OF 38
C-19

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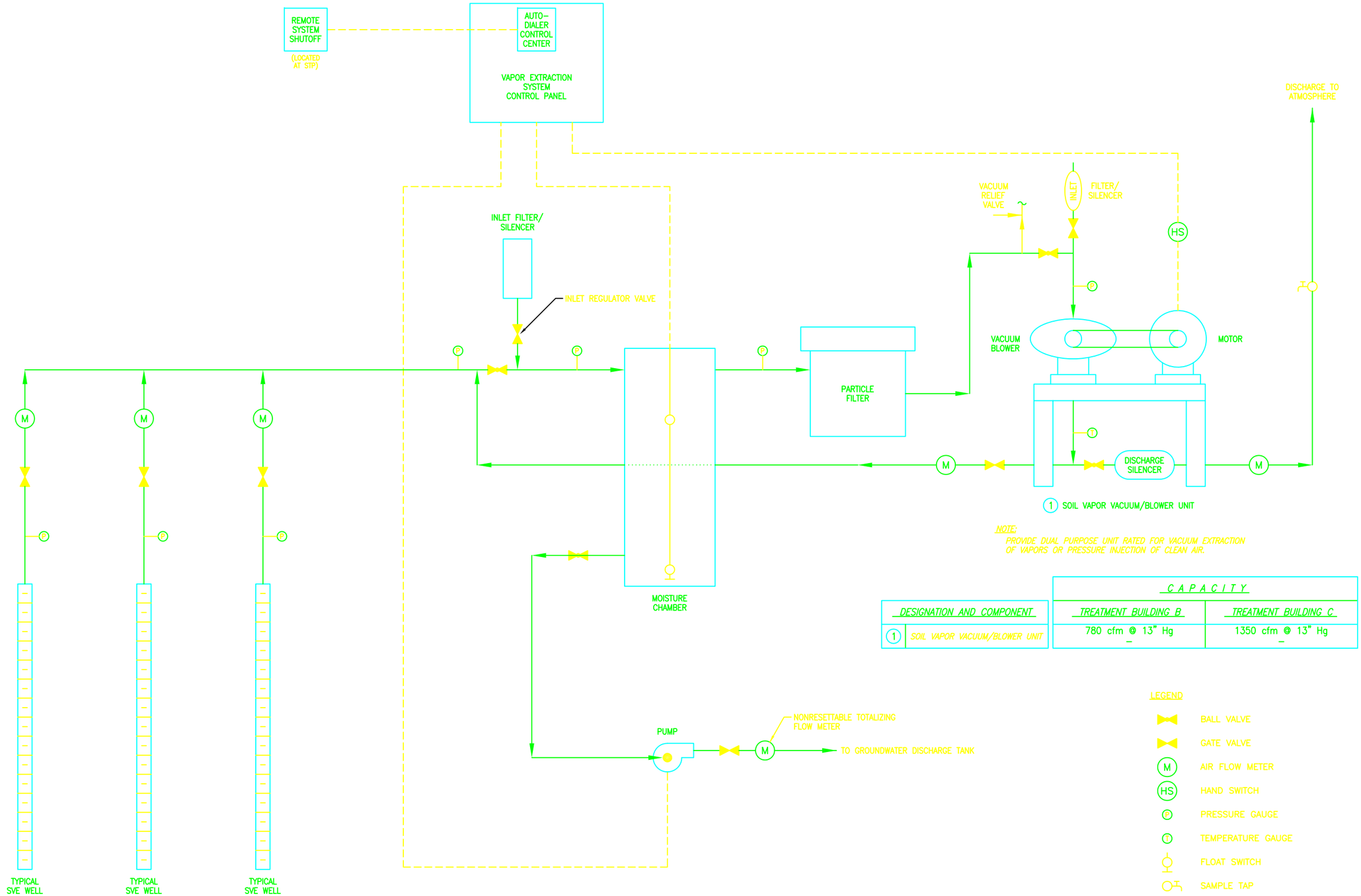

1 SOIL VAPOR VACUUM/BLOWER UNIT

NOTE:
PROVIDE DUAL PURPOSE UNIT RATED FOR VACUUM EXTRACTION OF VAPORS OR PRESSURE INJECTION OF CLEAN AIR.

DESIGNATION AND COMPONENT		CAPACITY	
		TREATMENT BUILDING B	TREATMENT BUILDING C
1	SOIL VAPOR VACUUM/BLOWER UNIT	780 cfm @ 13" Hg –	1350 cfm @ 13" Hg –

LEGEND

- BALL VALVE
- GATE VALVE
- (M) AIR FLOW METER
- (HS) HAND SWITCH
- (P) PRESSURE GAUGE
- (T) TEMPERATURE GAUGE
- FLOAT SWITCH
- SAMPLE TAP

DRAWING NOT TO SCALE

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

CONTRACTOR EFD
DESIGN
DRAWN
REVIEW
CHIEF ARCH / ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

McLaren Hart

A/E CONTRACT NO.
APPROVED DATE
ACTIVITY – SATISFACTORY TO
APPROVED DATE
FOR EFD FOR COMMANDER NAVFAC
SEAL

DEPARTMENT OF THE NAVY
NAVAL STATION
ATLANTIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
NORFOLK, VIRGINIA

MARINE CORPS AIR STATION CHERRY POINT, NORTH CAROLINA

BUILDING 4075 PIPELINE SITE REMEDIATION

"AS-BUILT" – SOIL VAPOR EXTRACTION SYSTEM SCHEMATIC

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 22 OF 38

C-20

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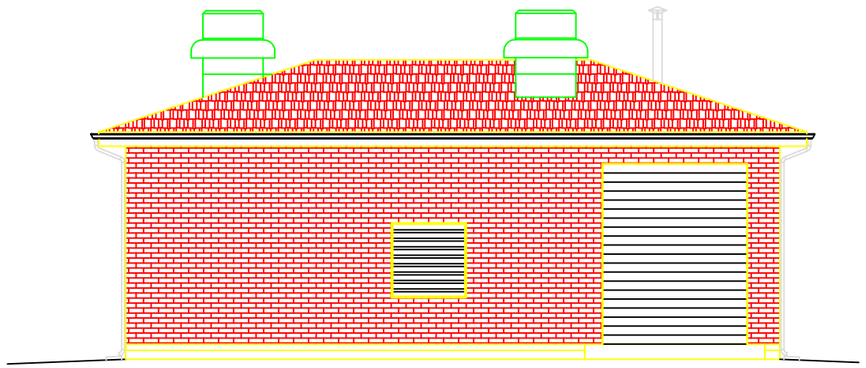
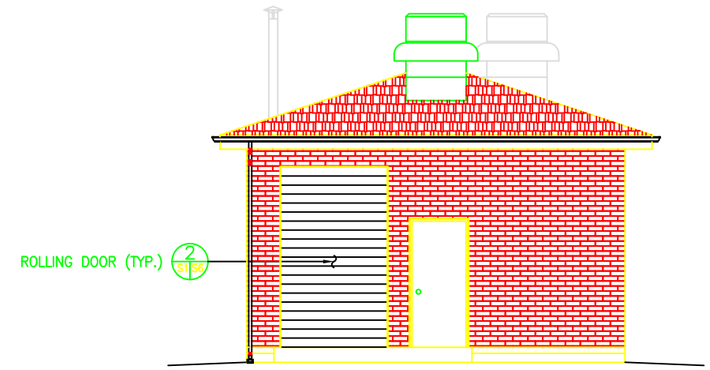


A S2 S1 WEST ELEVATION

(LOOKING EAST)
SCALE: 1/4" = 1'-0"

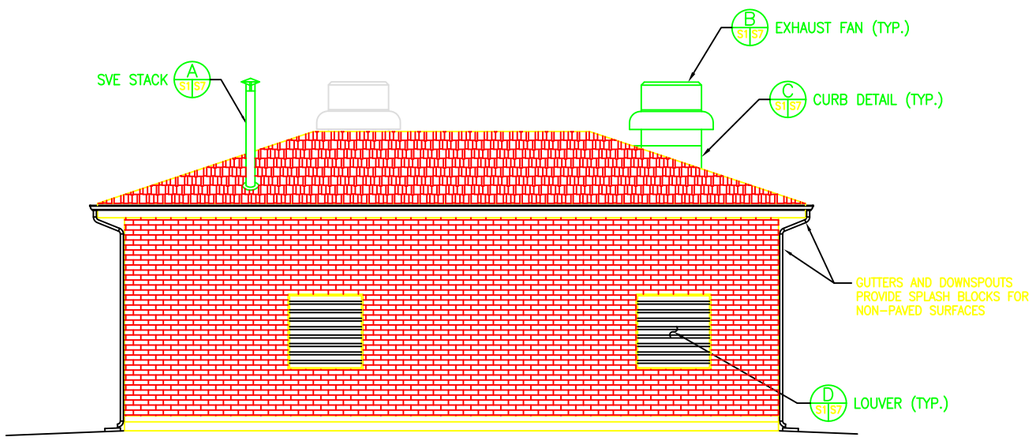


B S2 S1 NORTH ELEVATION

(LOOKING SOUTH)
SCALE: 1/4" = 1'-0"

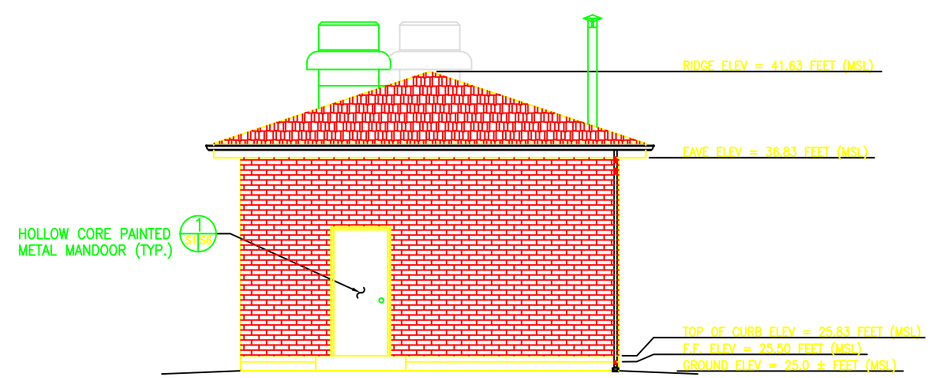
COLOR SCHEDULE

ITEM	COLOR
EXTERIOR	
ROOF SHINGLES	DOVE GRAY
BRICK	CAROLINA RED
FASCIA	WHITE
GUTTERS	WHITE
TRIM	WHITE
DOOR	MEDIUM BRONZE
INTERIOR	
ALL	NATURAL MATERIAL



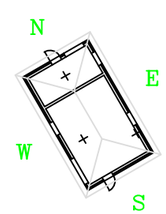
C S2 S1 EAST ELEVATION

(LOOKING WEST)
SCALE: 1/4" = 1'-0"



D S2 S1 SOUTH ELEVATION

(LOOKING NORTH)
SCALE: 1/4" = 1'-0"



KEY PLAN
NOT TO SCALE

GRAPHIC SCALE
IF THIS DRAWING IS A REDUCTION, USE GRAPHIC SCALE

1/4" = 1'-0" 1 0 1 2 3 4 5 10

REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVED

CONTRACTOR EFD
DESIGN
DRAWN
CHECK
CHIEF ARCH / ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

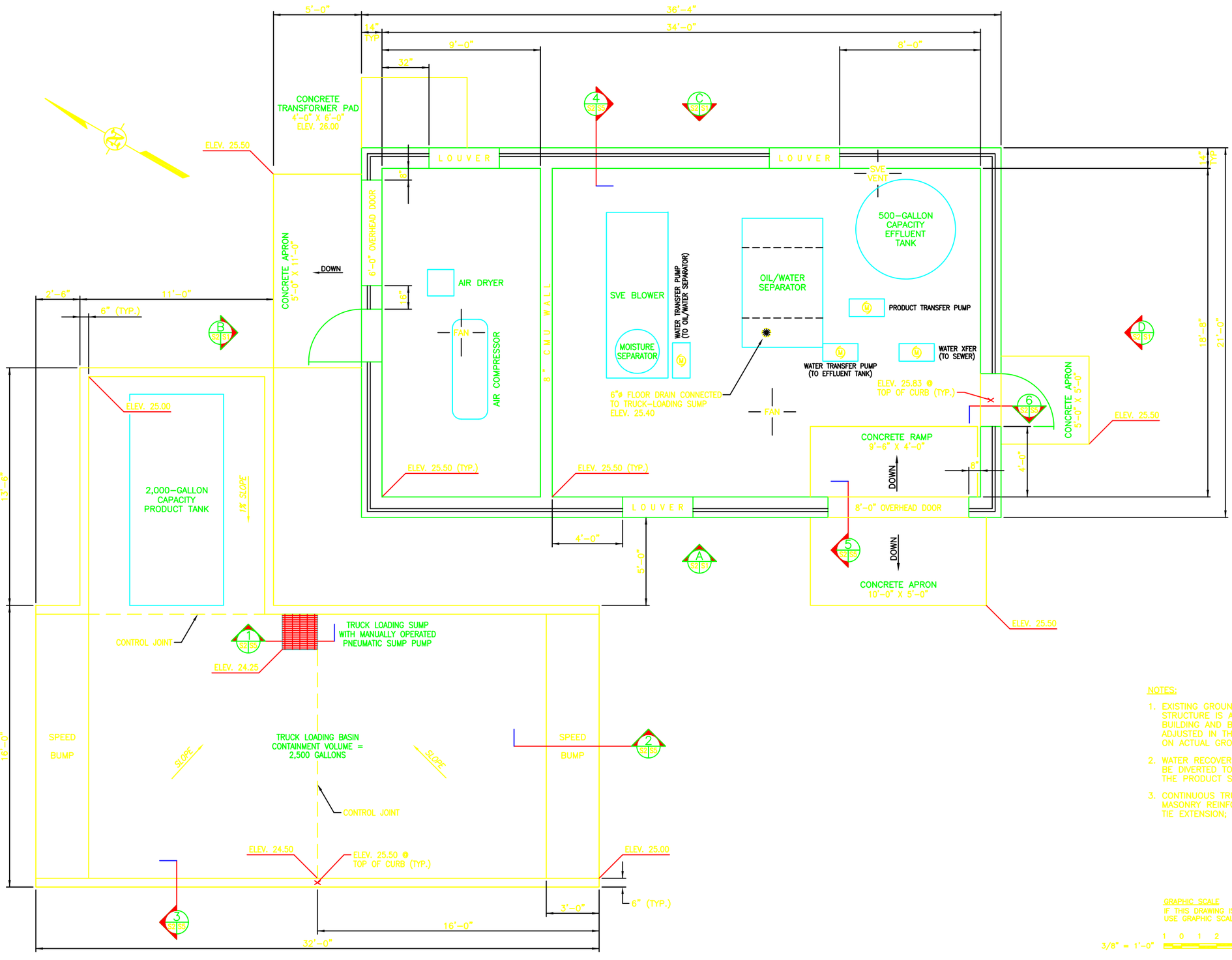
McLaren Hart

A/E CONTRACT NO.
APPROVED DATE
ACTIVITY - SATISFACTORY TO
APPROVED DATE
FOR EFD FOR COMMANDER INWING
SEAL

DEPARTMENT OF THE NAVY
NAVAL STATION
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA
BUILDING 4075 PIPELINE
SITE REMEDIATION
"AS-BUILT" - TREATMENT BUILDING B - ELEVATION

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 23 OF 38
S-1

SNO G:\CAD\DWG\0832\58320172 JAN29,2000 11:50AM PLOT: 1=48



NOTES:

1. EXISTING GROUND SURFACE ELEVATION NEAR STRUCTURE IS ASSUMED AT 25.00 FEET. BUILDING AND BASIN ELEVATIONS WERE ADJUSTED IN THE FIELD BY ENGINEER BASED ON ACTUAL GROUND SURFACE ELEVATIONS.
2. WATER RECOVERED IN SUMP WILL TYPICALLY BE DIVERTED TO STORMWATER DRAIN, UNLESS THE PRODUCT STORAGE TANK IS BEING EMPTIED.
3. CONTINUOUS TRUSS OR LADDER TYPE HORIZONTAL MASONRY REINFORCEMENT PROVIDED WITH BRICK TIE EXTENSION; INSTALLED EVERY OTHER COURSE.

GRAPHIC SCALE
IF THIS DRAWING IS A REDUCTION, USE GRAPHIC SCALE

3/8" = 1'-0" 1 0 1 2 3 4 5 10

REVISIONS

DESCRIPTION	DATE	APPROVED

CONTRACTOR EFD
DESIGN
DRAWN
CHKD
CHIEF ARCH/ ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

SEAL

McLaren Hart

A/E CONTRACT NO.
APPROVED DATE
ACTIVITY - SATISFACTORY TO
APPROVED DATE
FOR EFD FOR COMMANDER NAVFAC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL STATION ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION CHERRY POINT, NORTH CAROLINA

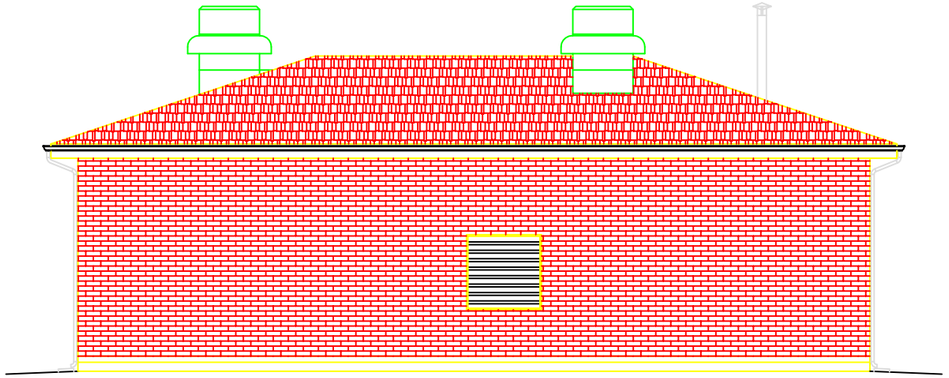
BUILDING 4075 PIPELINE SITE REMEDIATION

"AS-BUILT" - TREATMENT BUILDING B - FOUNDATION PLAN

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO.
NAVFAC DRAWING NO. NAVFAC DM-03-D-3033
SHEET 24 OF 38

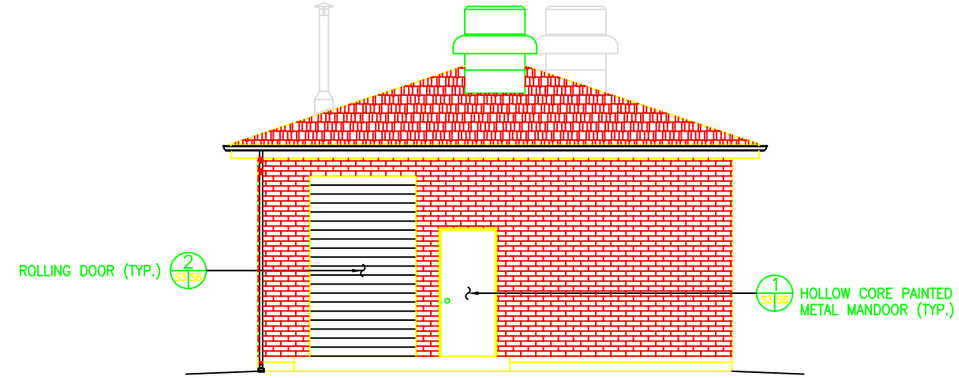
S-2

SHO G:\CAD\DWG\0832\53320173 MAR28,2000 2:55PM PLOT: 1=32



A S2|S3 WEST ELEVATION

(LOOKING EAST)
SCALE: 1/4" = 1'-0"

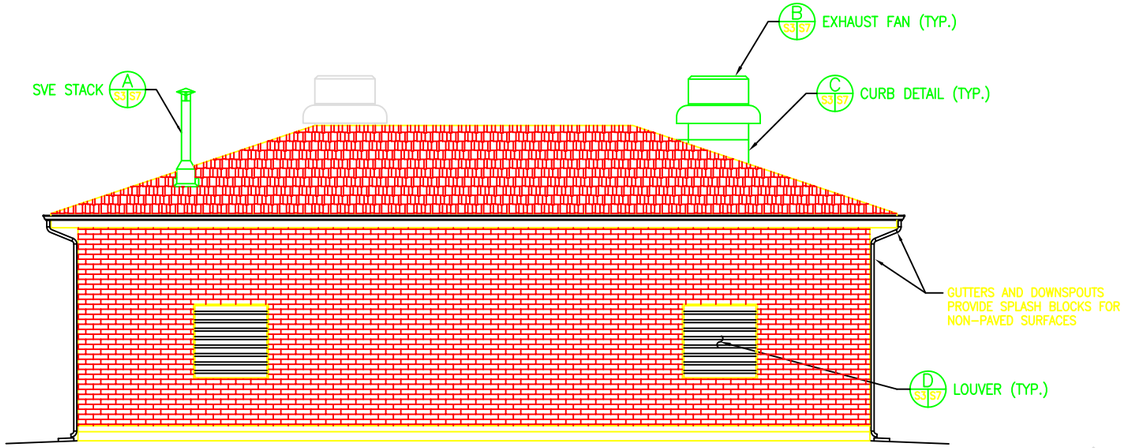


B S2|S3 NORTH ELEVATION

(LOOKING SOUTH)
SCALE: 1/4" = 1'-0"

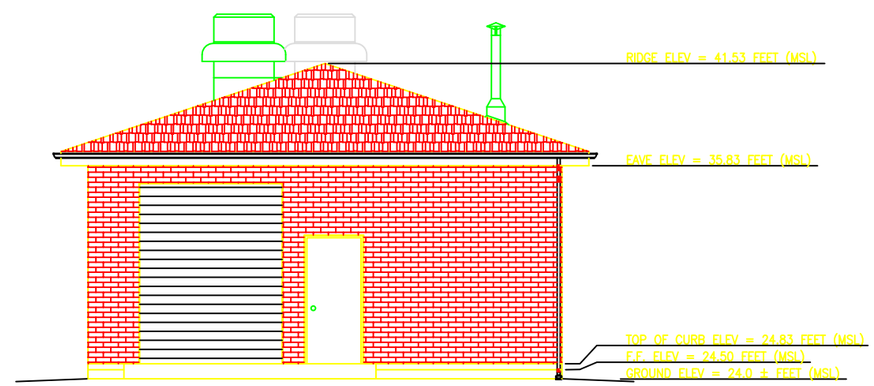
COLOR SCHEDULE

ITEM	COLOR
EXTERIOR	
ROOF SHINGLES	BLACK
BRICK	CAROLINA RED
FASCIA	BRONZE
GUTTERS	BRONZE
TRIM	BRONZE
DOOR	BRONZE
INTERIOR	
ALL	NATURAL MATERIAL



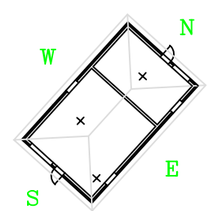
C S2|S3 EAST ELEVATION

(LOOKING WEST)
SCALE: 1/4" = 1'-0"



D S2|S3 SOUTH ELEVATION

(LOOKING NORTH)
SCALE: 1/4" = 1'-0"



KEY PLAN
NOT TO SCALE

GRAPHIC SCALE
IF THIS DRAWING IS A REDUCTION, USE GRAPHIC SCALE

1/4" = 1'-0" 1 0 1 2 3 4 5 10

REVISIONS

DESCRIPTION	DATE	APPROVED

CONTRACTOR EFD
DESIGN
DRAWN
REVIEW
CHIEF ARCH / ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR
SIGNAL

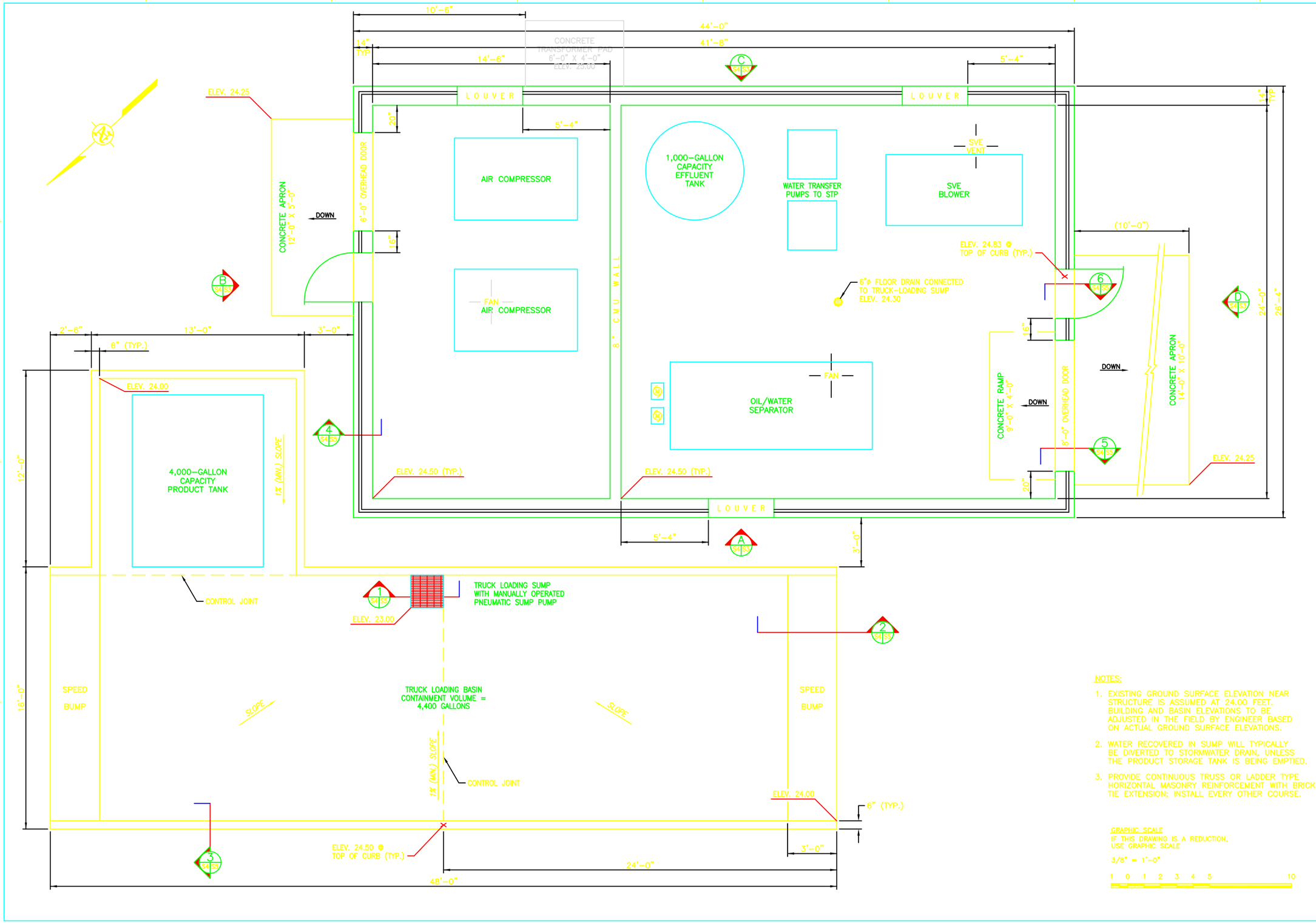
McLaren Hart

A/E CONTRACT NO. DATE
APPROVED
ACTIVITY - SATISFACTORY TO DATE
APPROVED
FOR EFD FOR COMMANDER SWFAC
SEAL

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
NAVAL STATION
MARINE CORPS AIR STATION CHERRY POINT NORTH CAROLINA
BUILDING 4075 PIPELINE
SITE REMEDIATION
"AS-BUILT" - TREATMENT BUILDING C - ELEVATION

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO.
N62470-97-D-3033
NAVFAC DRAWING NO.
SHEET 25 OF 38
S-3

SNO G:\CAD\DWG\0832\58320174 MAR22,2000 12:00AM PLOT: 1=48



NOTES:

1. EXISTING GROUND SURFACE ELEVATION NEAR STRUCTURE IS ASSUMED AT 24.00 FEET. BUILDING AND BASIN ELEVATIONS TO BE ADJUSTED IN THE FIELD BY ENGINEER BASED ON ACTUAL GROUND SURFACE ELEVATIONS.
2. WATER RECOVERED IN SUMP WILL TYPICALLY BE DIVERTED TO STORMWATER DRAIN, UNLESS THE PRODUCT STORAGE TANK IS BEING EMPTIED.
3. PROVIDE CONTINUOUS TRUSS OR LADDER TYPE HORIZONTAL MASONRY REINFORCEMENT WITH BRICK TIE EXTENSION; INSTALL EVERY OTHER COURSE.

GRAPHIC SCALE
IF THIS DRAWING IS A REDUCTION, USE GRAPHIC SCALE
3/8" = 1'-0"
1 0 1 2 3 4 5 10

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

CONTRACTOR EFD
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DESIGN
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PROJECT MANAGER
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BRANCH MANAGER
DESIGN DIRECTOR

McLaren Hart

A/E CONTRACT NO. DATE
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FOR EFD FOR COMMANDER INWAC
SEAL

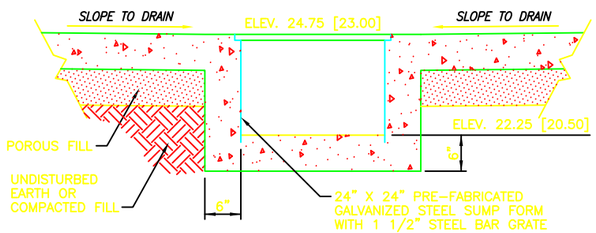
DEPARTMENT OF THE NAVY
NAVAL STATION
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION CHERRY POINT, NORTH CAROLINA

BUILDING 4075 PIPELINE SITE REMEDIATION

"AS-BUILT" - TREATMENT BUILDING C - FOUNDATION PLAN

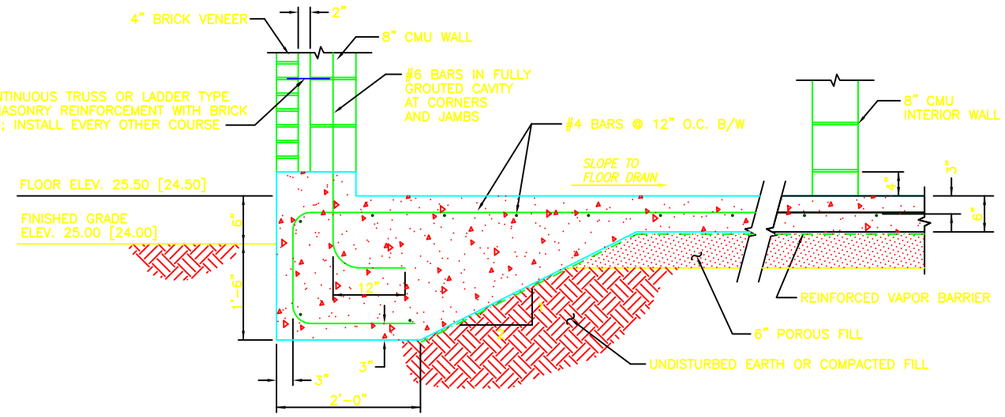
CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 26 OF 38
S-4

SNO C:\CAD\DWG\0832\58320175 .MAR22,2000 12:00AM PLOT: 1=32



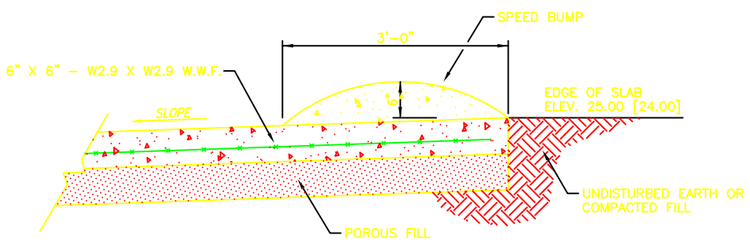
1 [S4] S2 S5 SUMP DETAIL

NOT TO SCALE



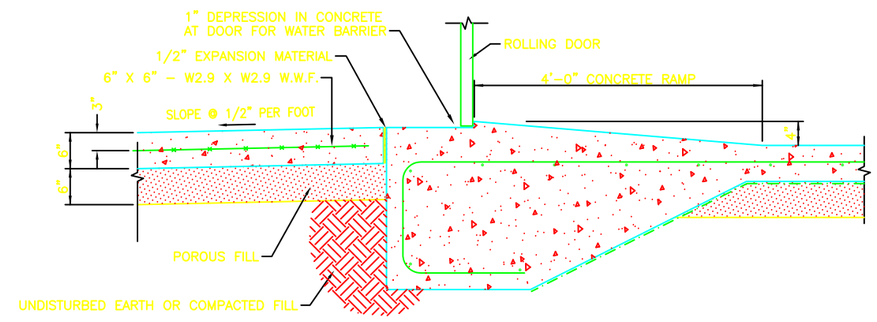
4 [S4] S2 S5 TYPICAL FOUNDATION WALL

NOT TO SCALE



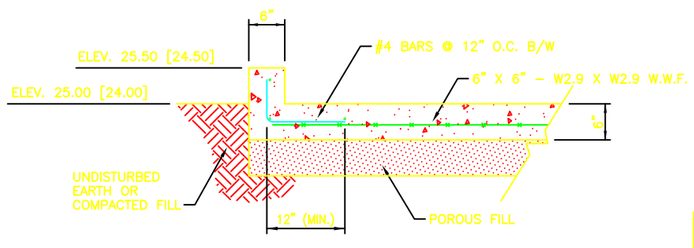
2 [S4] S2 S5 SPEED BUMP DETAIL

NOT TO SCALE



5 [S4] S2 S5 TYPICAL ROLLING DOOR WALL

NOT TO SCALE

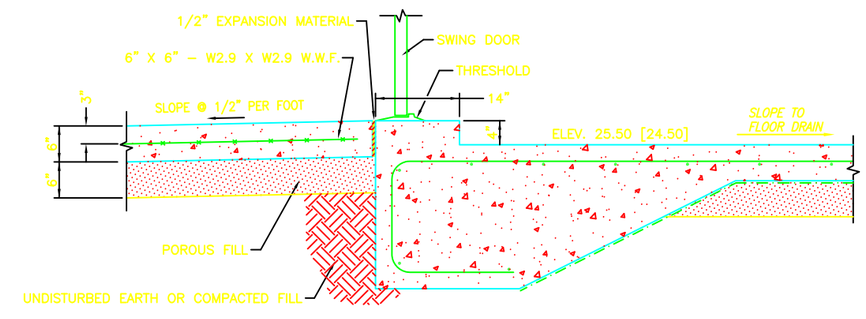


3 [S4] S2 S5 CURB, TRUCK-LOADING BASIN

NOT TO SCALE

NOTE:

TYPICAL ALL DETAILS:
ELEVATION SHOWN AS "ELEV. 24.75" REFERS TO TREATMENT BUILDING B. ELEVATION SHOWN AS [23.00] REFERS TO TREATMENT BUILDING C.



6 [S4] S2 S5 TYPICAL SWING DOOR WALL

NOT TO SCALE

REVISIONS

DESCRIPTION	DATE	APPROVED

CONTRACTOR
EFD DESIGN
DESIGN DRAWN
DRAWN CHECKED
CHECKED ARCH / ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR
SIGN.

McLaren Hart

A/E CONTRACT NO.
APPROVED DATE
ACTIVITY - SATISFACTORY TO DATE
APPROVED
FOR EFD, FOR COMMANDER NAVFAC
SIGN.

DEPARTMENT OF THE NAVY
NAVAL STATION
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

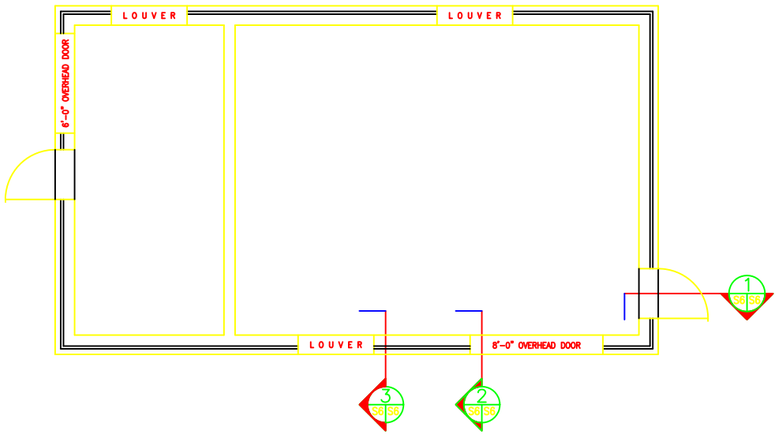
BUILDING 4075 PIPELINE SITE REMEDIATION

"AS-BUILT" - TREATMENT BUILDINGS B & C - FOUNDATION DETAILS

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO.
N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 27 OF 38

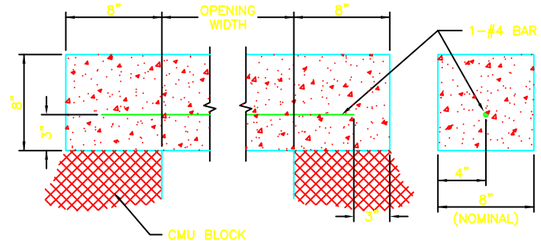
S-5

SNO G:\CAD\DWG\0832\&8320178 MAR22,2000 12:00AM PLOT: 1=12

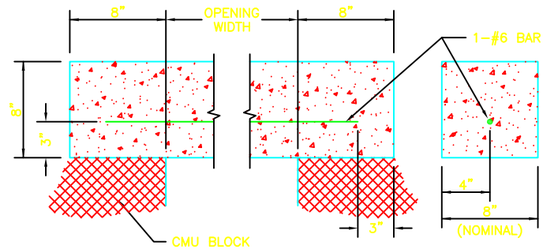


TYPICAL BUILDING PLAN

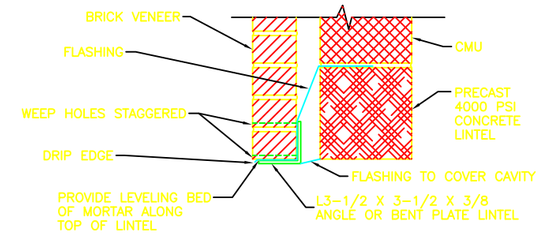
NOT TO SCALE



TYPE 1 LINTEL



TYPE 2 LINTEL

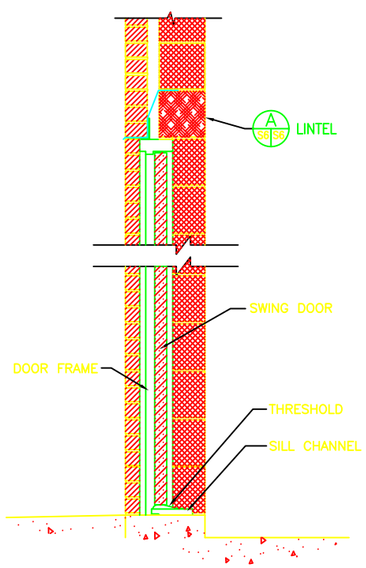


EXTERIOR WALL SECTION

LINTEL SCHEDULE		
TYPE	OPENING SIZE	OPENING
1	<= 60"	MAN DOOR/LOUVERS
2	61" TO 96"	ROLLING DOOR

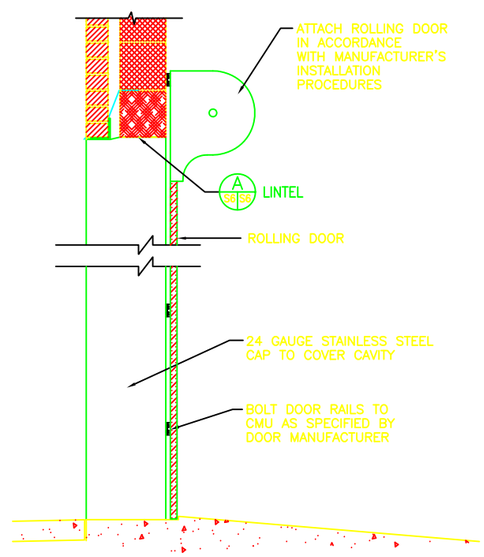
A S6 S6 LINTEL

NOT TO SCALE



1 S1,[S3] S6 S6 TYPICAL SWING DOOR

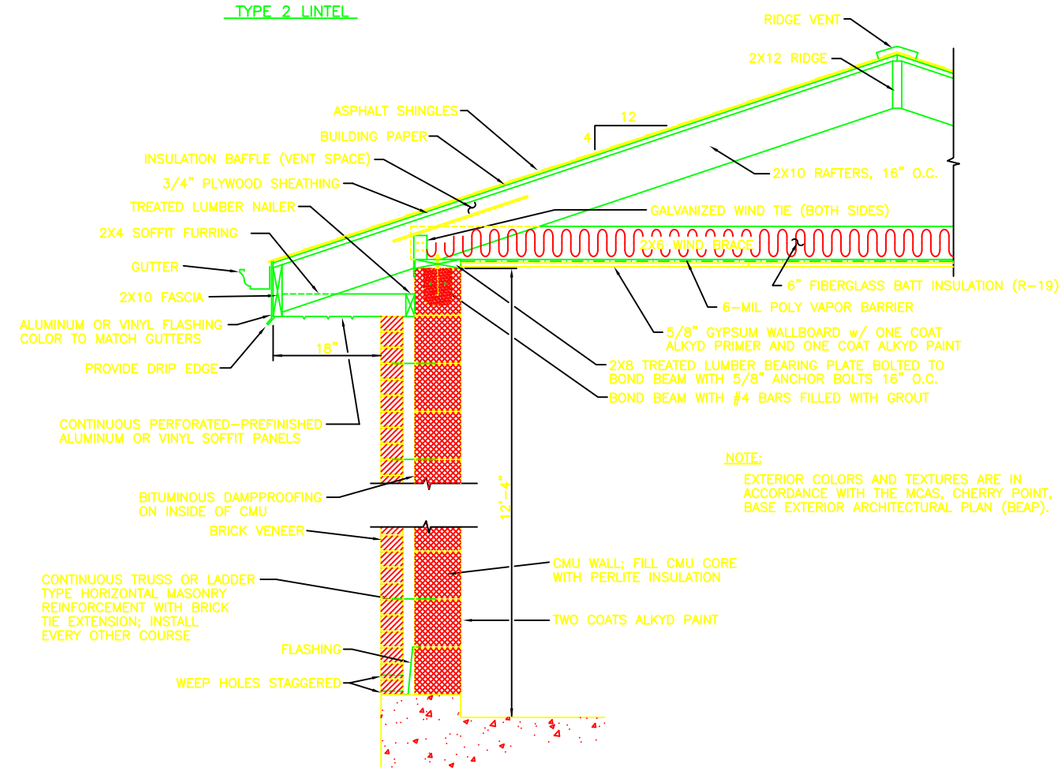
NOT TO SCALE



2 S1,[S3] S6 S6 TYPICAL ROLLING DOOR

NOT TO SCALE

DOOR SCHEDULE (BOTH BUILDINGS)			
NO.	DOOR SIZE	MATERIAL	DETAIL
1	3'-0" X 7'-0"	STEEL	1/S6/S6
2	8'-0" X 10'-0"	STEEL	2/S6/S6
3	6'-0" X 10'-0"	STEEL	2/S6/S6



NOTE:

EXTERIOR COLORS AND TEXTURES ARE IN ACCORDANCE WITH THE MCAS, CHERRY POINT, BASE EXTERIOR ARCHITECTURAL PLAN (BEAP).

3 S6 S6 TYPICAL BUILDING SECTION

NOT TO SCALE

DRAWING NOT TO SCALE

REVISIONS

DESCRIPTION	DATE	APPROVED

EFD

CONTRACTOR
DESIGN
DRAWN
CHECK
SUPERV ARCH / ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

EFN

McLaren Hart

A/E CONTRACT NO.
APPROVED DATE
ACTIVITY - SATISFACTORY TO
APPROVED DATE
FOR EFD FOR COMMANDER SWFAC
SEAL

DEPARTMENT OF THE NAVY
NAVAL STATION
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

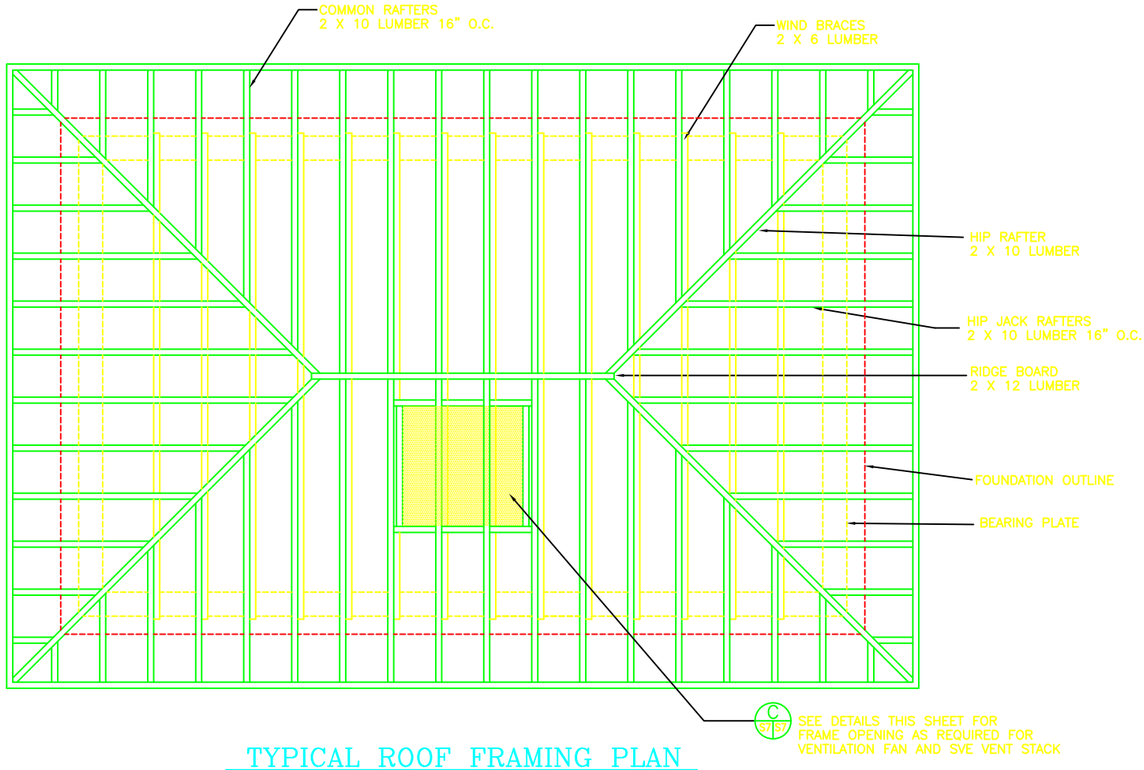
BUILDING 4075 PIPELINE SITE REMEDIATION

"AS-BUILT" - TREATMENT BUILDINGS B & C - BUILDING DETAILS

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 28 OF 38

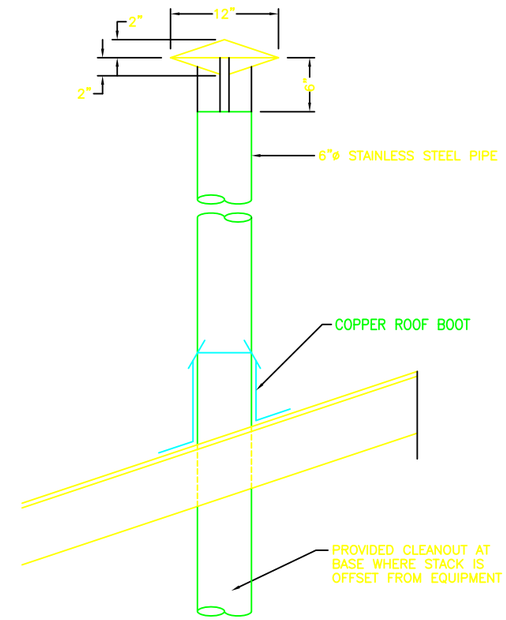
S-6

SNO G:\CAD\DWG\0832\58320177 4MAR22,2000 12:00AM PLOT: 1=12



TYPICAL ROOF FRAMING PLAN

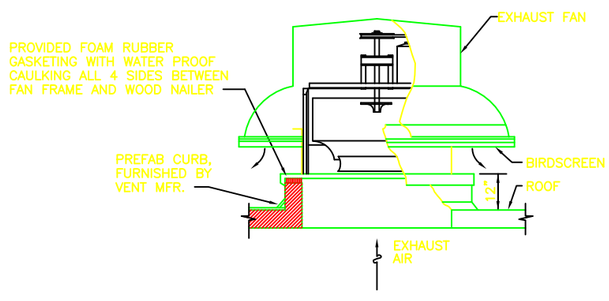
NOT TO SCALE



A SVE VENT STACK

S3 A S1 S7

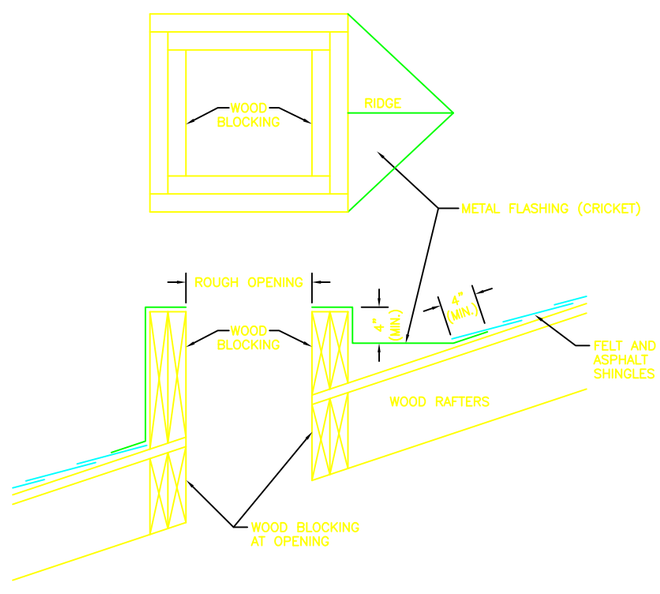
NOT TO SCALE



B EXHAUST FAN

S3 B S1 S7

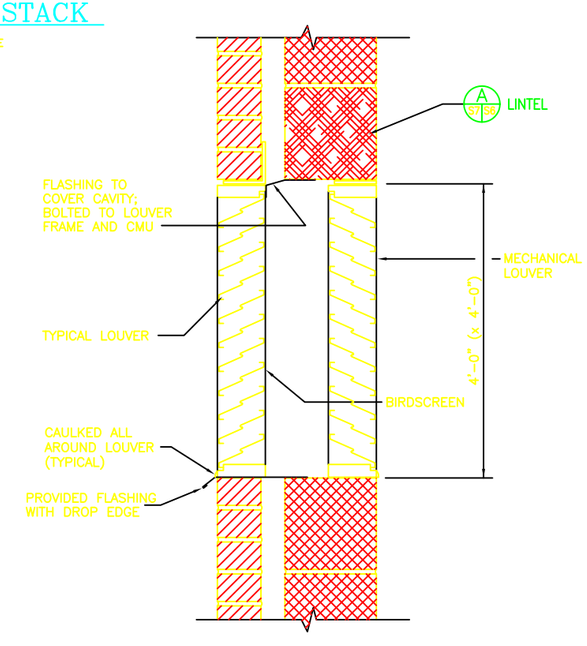
NOT TO SCALE



C CURB DETAIL

S1,S3 C S7 S7

NOT TO SCALE



D LOUVER (TYPICAL)

S3 D S1 S7

NOT TO SCALE

REVISIONS			
		DATE	APPROVED
	DESCRIPTION		
	EPM		

CONTRACTOR
EFD
DESIGN
DRAWN
CHECK
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

McLaren Hart

A/E CONTRACT NO.
APPROVED
DATE
ACTIVITY – SATISFACTORY TO
DATE
FOR EFD FOR COMMANDER NAVFAC
SEAL

DEPARTMENT OF THE NAVY
NAVAL STATION
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

BUILDING 4075 PIPELINE SITE REMEDIATION

"AS-BUILT" – TREATMENT BUILDINGS B & C – ROOF FRAMING DETAILS

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO.
N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 29 OF 38

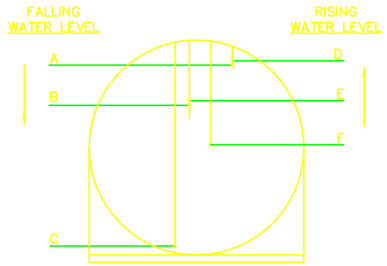
S-7

SIG G:\CAD\DWG\DB32\58320178 B AMR28.DWG 5:20PM PLOT: 1=24

A. DEACTIVATE HIGH HIGH LEVEL ALARM: SHUT OFF PANEL AND OUTSIDE "EFFLUENT TANK HIGH HIGH WATER" ALARM LIGHTS.

B. DEACTIVATE HIGH LEVEL INDICATOR: SHUT OFF "EFFLUENT TANK HIGH LEVEL" PANEL LIGHT.

C. LOW LEVEL CONDITION: TURN OFF EFFLUENT TRANSFER PUMP TO THE SEWAGE TREATMENT PLANT.



EFFLUENT TANK

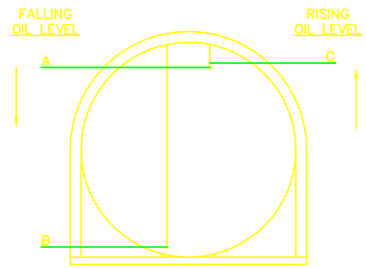
D. ACTIVATE HIGH HIGH LEVEL ALARM: TURN ON PANEL AND OUTSIDE ALARM LIGHTS, SHUT OFF PRODUCT AND GROUNDWATER RECOVERY PUMPS BY TURNING OFF POWER TO THE AIR COMPRESSOR AND BLEEDING OFF AIR PRESSURE FROM THE AIR SUPPLY TANK OF THE AIR COMPRESSOR, SHUT OFF POWER TO THE O/W SEPARATOR EFFLUENT TRANSFER PUMP.

E. ACTIVATE HIGH LEVEL INDICATOR: TURN ON EFFLUENT TRANSFER PUMP TO THE SEWAGE TREATMENT PLANT.

F. FREE PRODUCT SENSOR CONDITION: PRODUCT DETECTION – SHUT OFF PRODUCT AND GROUNDWATER RECOVERY PUMPS BY TURNING OFF POWER TO THE AIR COMPRESSOR AND BLEEDING OFF AIR PRESSURE FROM THE AIR SUPPLY TANK OF THE AIR COMPRESSOR, SHUT OFF POWER TO THE O/W SEPARATOR EFFLUENT TRANSFER PUMP AND THE EFFLUENT TRANSFER PUMP TO THE SEWAGE TREATMENT PLANT.

A. DEACTIVATE HIGH LEVEL ALARM: SHUT OFF PANEL AND OUTSIDE "PRODUCT TANK HIGH LEVEL" ALARM LIGHTS.

B. LOW LEVEL: TURN ON PRODUCT AND GROUNDWATER RECOVERY PUMPS BY RESTARTING THE AIR COMPRESSOR, RESTORE POWER TO THE O/W PRODUCT TRANSFER PUMP.



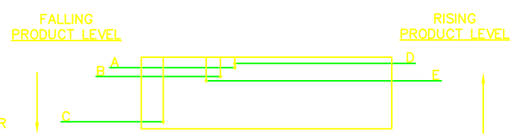
PRODUCT TANK LEVEL CONTROL LOGIC

C. HIGH LEVEL CONDITION: SHUT OFF PRODUCT AND GROUNDWATER RECOVERY PUMPS BY TURNING OFF POWER TO THE AIR COMPRESSOR AND BLEEDING OFF AIR PRESSURE FROM THE AIR SUPPLY TANK OF THE AIR COMPRESSOR, SHUT OFF POWER TO THE O/W SEPARATOR PRODUCT TRANSFER PUMP.

A. DEACTIVATE HIGH LEVEL ALARM: SHUT OFF PANEL AND OUTSIDE "OIL/WATER SEPARATOR PRODUCT HIGH LEVEL" ALARM LIGHTS.

B. TRANSFER PUMP RUNNING: "O/W PRODUCT TRANSFER PUMP" PANEL RUN LIGHT ON.

C. LOW LEVEL CONDITION: TURN OFF O/W SEPARATOR PRODUCT TRANSFER PUMP.



OIL/WATER SEPARATOR PRODUCT LEVEL CONTROL LOGIC

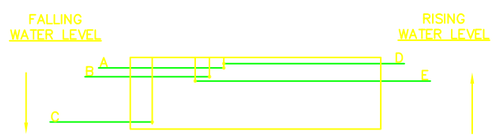
D. ACTIVATE HIGH HIGH PRODUCT LEVEL ALARM: SHUT OFF PRODUCT AND GROUNDWATER RECOVERY PUMPS BY TURNING OFF POWER TO AIR COMPRESSOR AND BLEEDING OFF AIR PRESSURE FROM AIR SUPPLY TANK ON AIR COMPRESSOR.

E. HIGH LEVEL CONDITION: TURN ON O/W SEPARATOR PRODUCT TRANSFER PUMP.

A. DEACTIVATE HIGH LEVEL ALARM: SHUT OFF PANEL AND OUTSIDE "OIL/WATER SEPARATOR WATER HIGH LEVEL" ALARM LIGHTS.

B. TRANSFER PUMP RUNNING: "O/W WATER TRANSFER PUMP" PANEL RUN LIGHT ON.

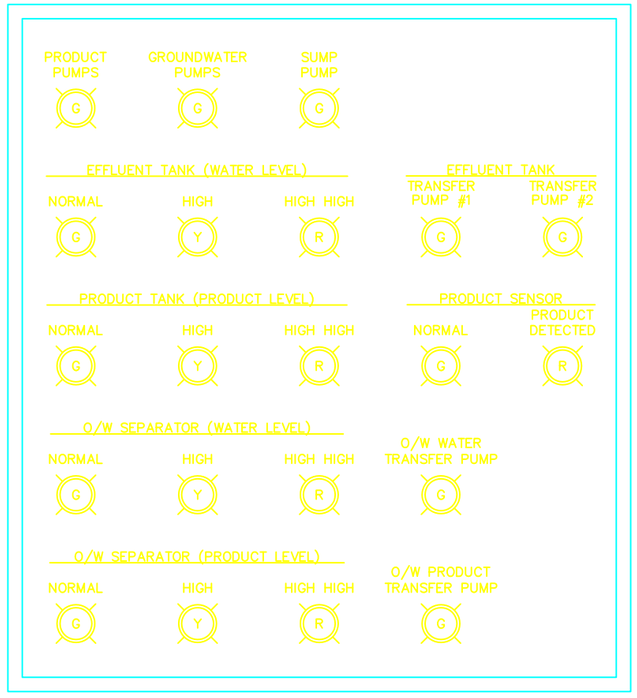
C. LOW LEVEL CONDITION: TURN OFF O/W SEPARATOR EFFLUENT TRANSFER PUMP.



OIL/WATER SEPARATOR WATER LEVEL CONTROL LOGIC

D. ACTIVATE HIGH HIGH PRODUCT LEVEL ALARM: SHUT OFF PRODUCT AND GROUNDWATER RECOVERY PUMPS BY TURNING OFF POWER TO AIR COMPRESSOR AND BLEEDING OFF AIR PRESSURE FROM AIR SUPPLY TANK ON AIR COMPRESSOR.

E. HIGH LEVEL CONDITION: TURN ON O/W SEPARATOR EFFLUENT TRANSFER PUMP.



CONTROL PANEL

NOTE:
CONTROL PANEL SHALL BE CUSTOM BUILT BY MANUFACTURER.

DRAWING NOT TO SCALE

REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVED

CONTRACTOR EFD
DESIGN
DRAWN
REVIEW
CHIEF ARCH./ ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

McLaren Hart

A/E CONTRACT NO. DATE
APPROVED
ACTIVITY – SATISFACTORY TO DATE
APPROVED
FOR EFD FOR COMMANDER (NAVFAC)
SEAL

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL STATION ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION CHERRY POINT, NORTH CAROLINA
BUILDING 4075 PIPELINE
SITE REMEDIATION
"AS-BUILT" – TREATMENT BUILDING B – CONTROL LOGIC

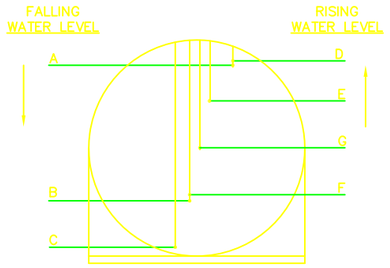
CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 30 OF 38
L-1

SND G:\CAD\DWG\D832\58320179 .MAR22,2000 12:00AM

A. DEACTIVATE HIGH HIGH LEVEL ALARM: SHUT OFF PANEL AND OUTSIDE "EFFLUENT TANK HIGH HIGH WATER" ALARM LIGHTS.

B. 25% HIGH LEVEL: TURN OFF LEAD EFFLUENT TRANSFER PUMP TO THE SEWAGE TREATMENT PLANT

C. LOW LEVEL: TURN OFF LAG EFFLUENT TRANSFER PUMP TO THE SEWAGE TREATMENT PLANT.



EFFLUENT TANK

D. ACTIVATE HIGH HIGH LEVEL ALARM: TURN ON PANEL AND OUTSIDE ALARM LIGHTS, SHUT OFF PRODUCT AND GROUNDWATER RECOVERY PUMPS BY TURNING OFF POWER TO THE AIR COMPRESSOR AND BLEEDING OFF AIR PRESSURE FROM THE AIR SUPPLY TANK OF THE AIR COMPRESSOR, SHUT OFF POWER TO THE O/W SEPARATOR EFFLUENT TRANSFER PUMP.

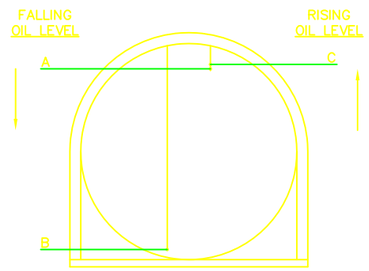
E. 75% HIGH LEVEL: TURN ON LAG EFFLUENT TRANSFER PUMP TO THE SEWAGE TREATMENT PLANT.

F. 25% HIGH LEVEL: TURN ON LEAD EFFLUENT TRANSFER PUMP TO THE SEWAGE TREATMENT PLANT.

G. FREE PRODUCT SENSOR CONDITION: PRODUCT DETECTION – SHUT OFF PRODUCT AND GROUNDWATER RECOVERY PUMPS BY TURNING OFF POWER TO THE AIR COMPRESSOR AND BLEEDING OFF AIR PRESSURE FROM THE AIR SUPPLY TANK OF THE AIR COMPRESSOR, SHUT OFF POWER TO THE O/W SEPARATOR EFFLUENT TRANSFER PUMP AND THE EFFLUENT TRANSFER PUMPS TO THE SEWAGE TREATMENT PLANT.

A. DEACTIVATE HIGH LEVEL ALARM: SHUT OFF PANEL AND OUTSIDE "PRODUCT TANK HIGH LEVEL" ALARM LIGHTS.

B. LOW LEVEL: TURN ON PRODUCT AND GROUNDWATER RECOVERY PUMPS BY RESTARTING THE AIR COMPRESSOR, RESTORE POWER TO THE O/W PRODUCT TRANSFER PUMP.



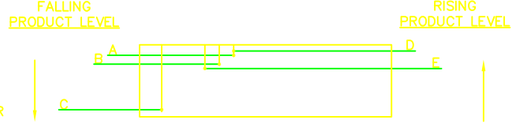
PRODUCT TANK LEVEL CONTROL LOGIC

C. HIGH LEVEL CONDITION: SHUT OFF PRODUCT AND GROUNDWATER RECOVERY PUMPS BY TURNING OFF POWER TO THE AIR COMPRESSOR AND BLEEDING OFF AIR PRESSURE FROM THE AIR SUPPLY TANK OF THE AIR COMPRESSOR, SHUT OFF POWER TO THE O/W SEPARATOR PRODUCT TRANSFER PUMP.

A. DEACTIVATE HIGH LEVEL ALARM: SHUT OFF PANEL AND OUTSIDE "OIL/WATER SEPARATOR PRODUCT HIGH LEVEL" ALARM LIGHTS.

B. TRANSFER PUMP RUNNING: "O/W PRODUCT TRANSFER PUMP" PANEL RUN LIGHT ON.

C. LOW LEVEL CONDITION: TURN OFF O/W SEPARATOR PRODUCT TRANSFER PUMP.



OIL/WATER SEPARATOR PRODUCT LEVEL CONTROL LOGIC

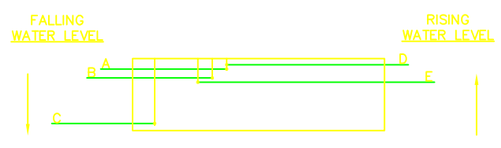
D. ACTIVATE HIGH HIGH PRODUCT LEVEL ALARM: SHUT OFF PRODUCT AND GROUNDWATER RECOVERY PUMPS BY TURNING OFF POWER TO AIR COMPRESSOR AND BLEEDING OFF AIR PRESSURE FROM AIR SUPPLY TANK ON AIR COMPRESSOR.

E. HIGH LEVEL CONDITION: TURN ON O/W SEPARATOR PRODUCT TRANSFER PUMP.

A. DEACTIVATE HIGH LEVEL ALARM: SHUT OFF PANEL AND OUTSIDE "OIL/WATER SEPARATOR WATER HIGH LEVEL" ALARM LIGHTS.

B. TRANSFER PUMP RUNNING: "O/W WATER TRANSFER PUMP" PANEL RUN LIGHT ON.

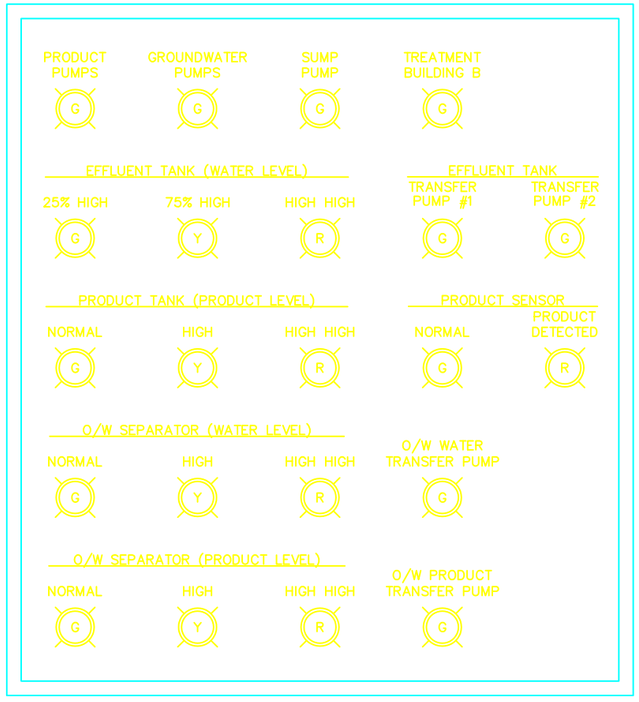
C. LOW LEVEL CONDITION: TURN OFF O/W SEPARATOR EFFLUENT TRANSFER PUMP.



OIL/WATER SEPARATOR WATER LEVEL CONTROL LOGIC

D. ACTIVATE HIGH HIGH PRODUCT LEVEL ALARM: SHUT OFF PRODUCT AND GROUNDWATER RECOVERY PUMPS BY TURNING OFF POWER TO AIR COMPRESSOR AND BLEEDING OFF AIR PRESSURE FROM AIR SUPPLY TANK ON AIR COMPRESSOR.

E. HIGH LEVEL CONDITION: TURN ON O/W SEPARATOR EFFLUENT TRANSFER PUMP.



CONTROL PANEL

NOTE:
CONTROL PANEL SHALL BE CUSTOM BUILT BY MANUFACTURER.

DRAWING NOT TO SCALE

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

CONTRACTOR
EFD
DESIGN
DRAWN
SUPERVISOR
CHIEF ARCH / ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

McLaren Hart

A/E CONTRACT NO.
APPROVED DATE
ACTIVITY – SATISFACTORY TO
APPROVED DATE
FOR EFD FOR COMMANDER NAVFAC
SEAL

DEPARTMENT OF THE NAVY
NAVAL STATION
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

BUILDING 4075 PIPELINE
SITE REMEDIATION

"AS-BUILT" – TREATMENT BUILDING C – CONTROL LOGIC

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 31 OF 38

L-2

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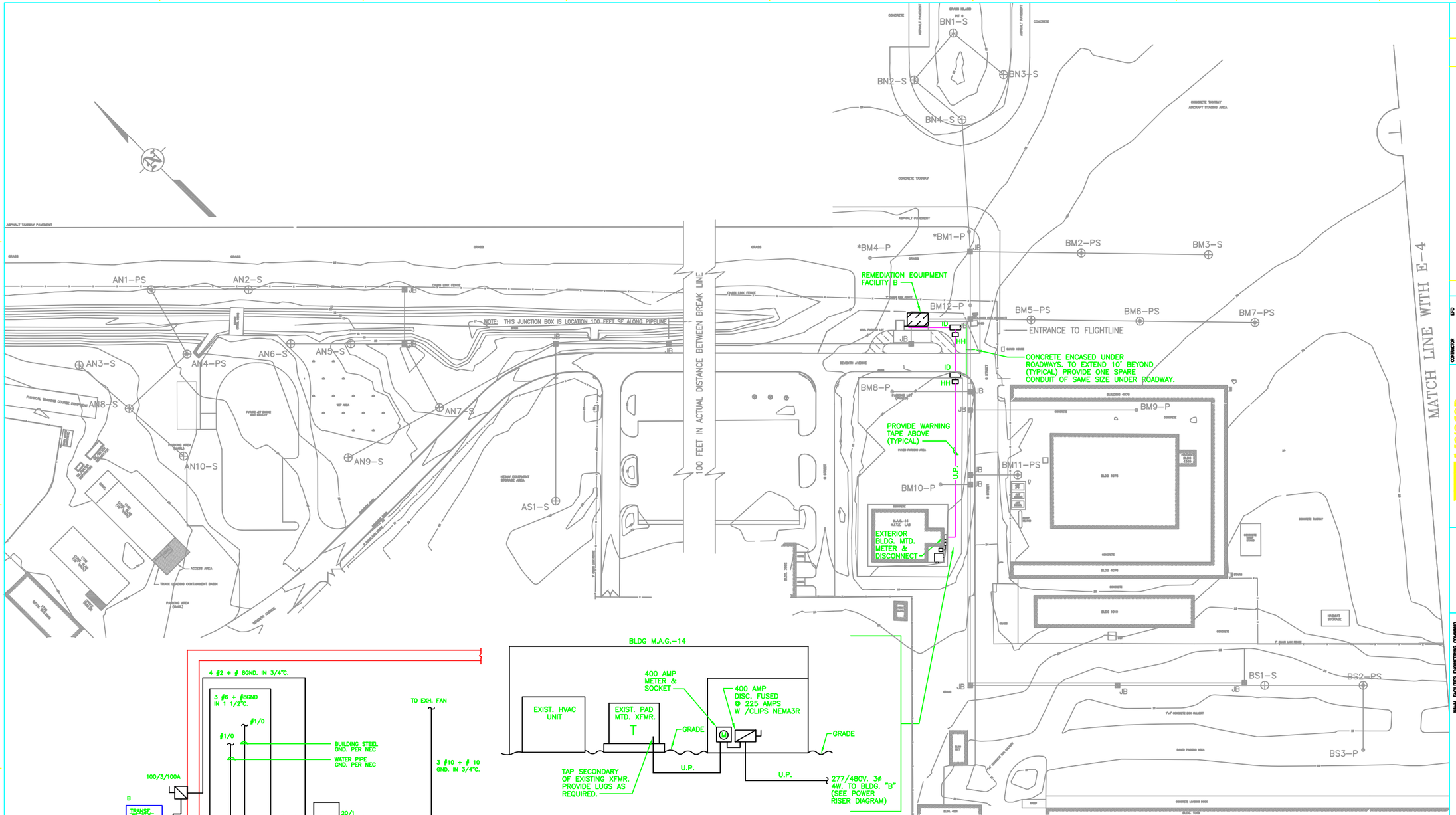
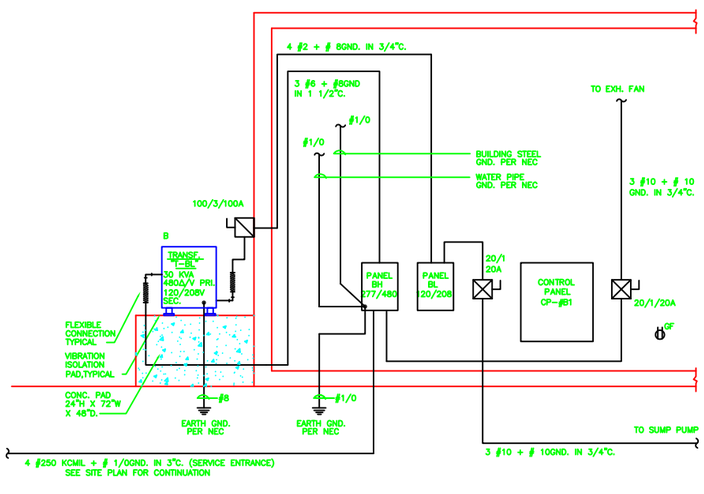




BUILDING "B" POWER RISER DIAGRAM

NO SCALE

EAST ELEVATION OF BULIDING M.A.G. 14

NO SCALE

SHEET INDEX

REFERENCE:

BACKGROUND MAPPING OBTAINED FROM RICHARD CATLIN ASSOCIATES INC., CONTRACT NO. N62470–93–4020, "BUILDING 4075 PIPELINE SITE REMEDIATION FINAL SUBMITTAL," MARINE CORPS AIR STATION, CHERRY POINT, N.C., FEBRUARY 28, 1996

GRAPHIC SCALE

IF THIS DRAWING IS A REDUCTION, USE GRAPHIC SCALE

1" = 60'–0"

0 60 120 180 240

REVISIONS

DESCRIPTION	DATE	APPROVED
FINAL		

CONTRACTOR: EFD
DESIGN
DRAWN
CHKD
CHIEF ARCH / ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

McLaren Hart

A/E CONTRACT NO.
APPROVED
ACTIVITY – SATISFACTORY TO
APPROVED
FOR EFD FOR COMMANDER INWAC
SIGN.

DEPARTMENT OF THE NAVY
NAVAL STATION
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA

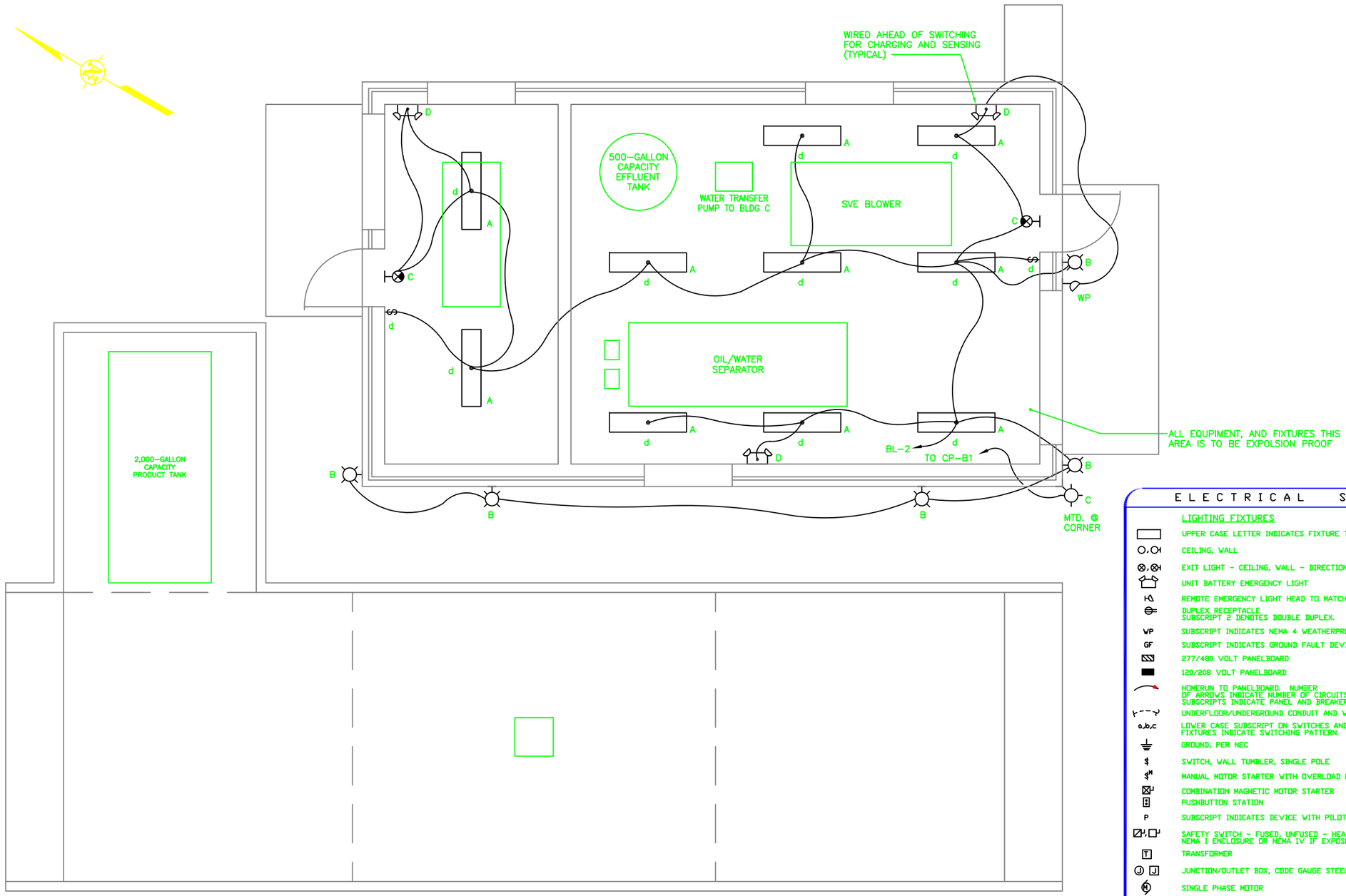
BUILDING 4075 PIPELINE SITE REMEDIATION

"AS–BUILT" – TREATMENT BUILDING B – ELECTRICAL SITE PLAN

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO. N62470–93–D–3033
NAVFAC DRAWING NO.
SHEET 32 OF 38

E–1

SNO G:\CAD\INWC\8632\58320181 FEB2,2001 12:50AM PLOT: 1=60



ELECTRICAL SYMBOLS

LIGHTING FIXTURES

- UPPER CASE LETTER INDICATES FIXTURE TYPE - SEE FIXTURE SCHEDULE.
- CEILING, WALL
- EXIT LIGHT - CEILING, WALL - DIRECTIONAL ARROWS WHERE SHOWN
- UNIT BATTERY EMERGENCY LIGHT
- REMOTE EMERGENCY LIGHT HEAD TO MATCH BATTERY PACK UNIT
- DUPLEX RECEPTACLE. SUBSCRIPT 2 DENOTES DOUBLE DUPLEX.
- WP — SUBSCRIPT INDICATES NEMA 4 WEATHERPROOF
- GF — SUBSCRIPT INDICATES GROUND FAULT DEVICE
- 277/480 VOLT PANELBOARD
- 120/208 VOLT PANELBOARD
- HOMERUN TO PANELBOARD. NUMBER OF ARROWS INDICATE NUMBER OF CIRCUITS. SUBSCRIPTS INDICATE PANEL AND BREAKER NUMBER.
- UNDERFLOOR/UNDERGROUND CONDUIT AND WIRING
- a,b,c — LOWER CASE SUBSCRIPT ON SWITCHES AND LIGHTING FIXTURES INDICATE SWITCHING PATTERN.
- GROUND, PER NEC
- SWITCH, WALL TUMBLER, SINGLE POLE
- MANUAL MOTOR STARTER WITH OVERLOAD PROTECTION
- COMBINATION MAGNETIC MOTOR STARTER
- PUSHBUTTON STATION
- P — SUBSCRIPT INDICATES DEVICE WITH PILOT LIGHT
- SAFETY SWITCH - FUSED, UNFUSED - HEAVY DUTY, NEMA I ENCLOSURE OR NEMA IV IF EXPOSED TO WEATHER
- T — TRANSFORMER
- J — JUNCTION/OUTLET BOX, CODE GAUGE STEEL, SIZE PER CODE
- M — SINGLE PHASE MOTOR
- M — THREE PHASE MOTOR
- CONDUIT UP
- CONDUIT DOWN
- T — THERMOSTAT
- A — UNIT HEATER

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

CONTRACTOR
EFD
DESIGN
DRAWN
REVIEW
CHIEF ARCH/ ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

McLaren Hart

A/E CONTRACT NO.
APPROVED DATE
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SEAL

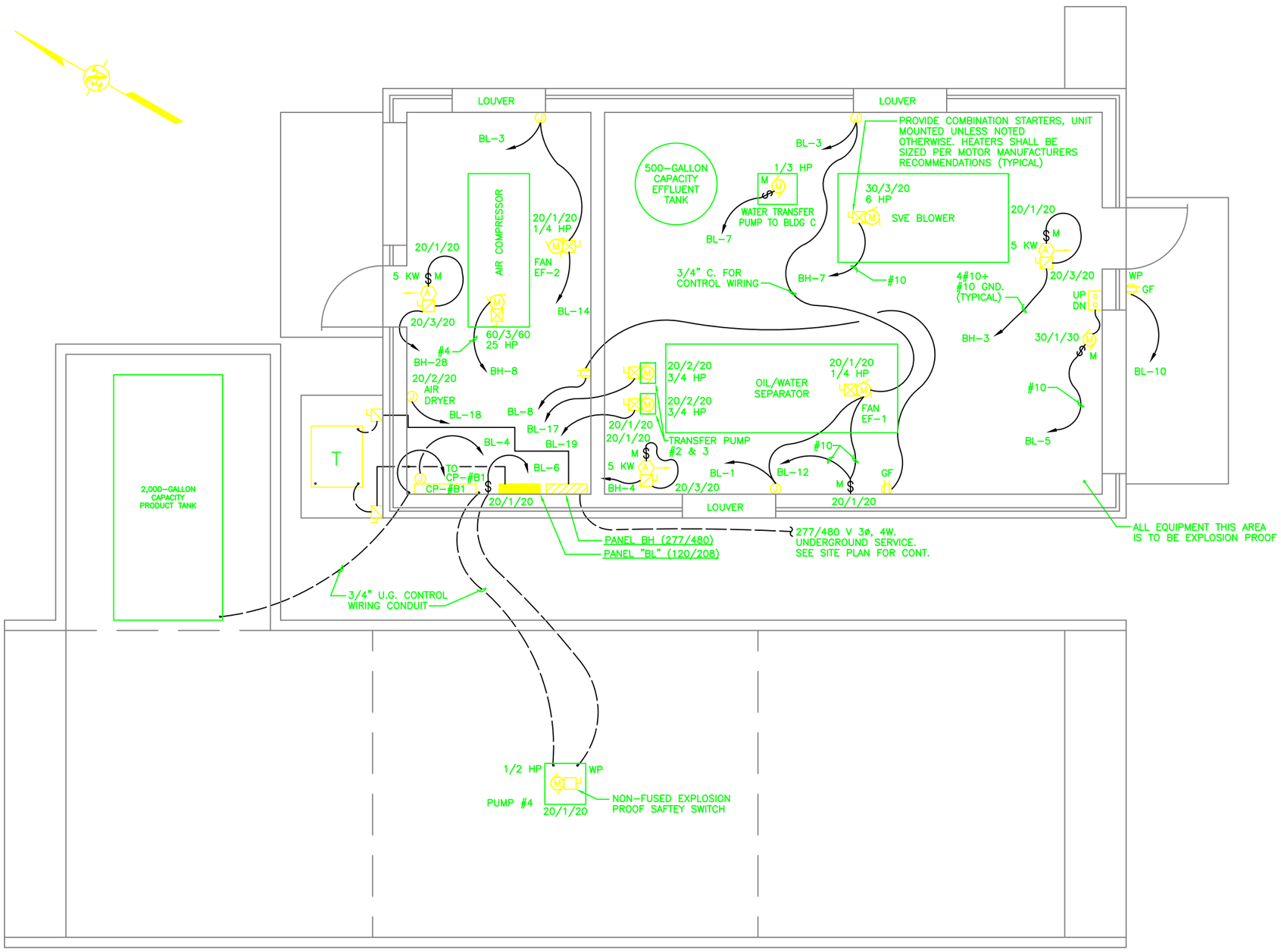
DEPARTMENT OF THE NAVY
NAVAL STATION
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION CHERRY POINT, NORTH CAROLINA

BUILDING 4075 PIPELINE SITE REMEDIATION

"AS-BUILT" - TREATMENT BUILDING B - LIGHTING PLAN

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 33 OF 38
E-2

SNO G:\CAD\DWG\0832\08320181 FEB2,2001 12:00AM PLOT: 1=32



NOTES:

1. EXISTING GROUND SURFACE ELEVATION NEAR STRUCTURE IS ASSUMED AT 25.00 FEET. BUILDING AND BASIN ELEVATIONS TO BE ADJUSTED IN THE FIELD BASED ON ACTUAL GROUND SURFACE ELEVATIONS.
2. WATER RECOVERED IN SUMP WILL TYPICALLY BE DIVERTED TO STORMWATER DRAIN, UNLESS THE PRODUCT STORAGE TANK IS BEING EMPTIED.
3. PROVIDE CONTINUOUS TRUSS OR LADDER TYPE HORIZONTAL MASONRY REINFORCEMENT WITH BRICK TIE EXTENSION; INSTALL EVERY OTHER COURSE.

REVISIONS

DESCRIPTION	DATE	APPROVED

CONTRACTOR
EFD
DESIGN
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CHIEF ARCH/ ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

McLaren Hart

A/E CONTRACT NO.
APPROVED DATE
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SEAL

DEPARTMENT OF THE NAVY
NAVAL STATION
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

BUILDING 4075 PIPELINE SITE REMEDIATION

"AS-BUILT" - TREATMENT BUILDING B - WIRING PLAN

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO.
N62470-98-B-D-3033
NAVFAC DRAWING NO.
SHEET 34 OF 38

E-3

SKD G:\CAD\DWG\0832\SB32D183 FEB2,2001 12:00AM PLOT: 1=32

WORK AREA C NORTH

WORK AREA C SOUTH (TANK FARM A)

MATCH LINE WITH RFI009A

MATCH LINE WITH RFI009C

ENTRANCE TO FLIGHTLINE

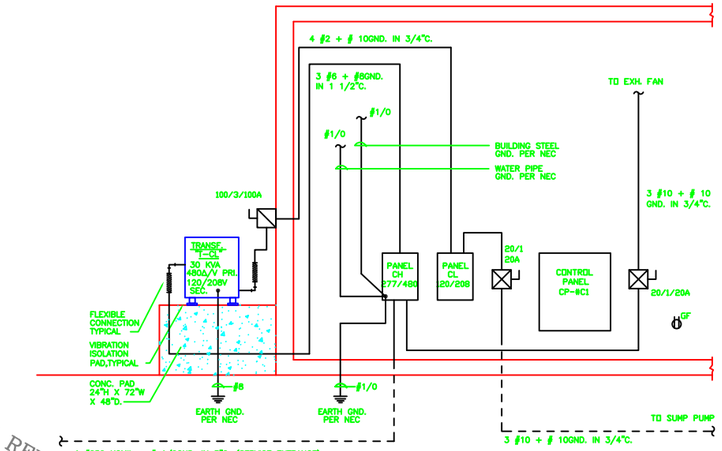
*CN1-P, *CN2-P, CN3-S, CN4-P, CN5-PS, CN6-S, *CN7-PS, *CN8-PS, CN10-PS, CN11-PS, CN12-P, CN13-P, CN14-P, CN15-P, CN16-P, CN17-P, CN18-P, CN19-P, CN20-P, CN21-P, CN22-P, CN23-P, CN24-PS, CN25-S, CN26-S, CN27-S, CS1-PS, CS2-PS, CS3-S, CS4-P, CS5-PS, CS6-PS, CS7-P, CS8-PS, CS9-S, CS10-PS, CS11-PS, CS12-PS, CS13-S, CS14-PS, CS15-S, CS16-PS, CS17-PS, CS18-PS, CS19-PS, CS20-PS, CS21-PS, CS22-S, CS23-PS

REMEDIATION EQUIPMENT FACILITY

PROVIDE WARNING TAP ABOVE (TYPICAL)

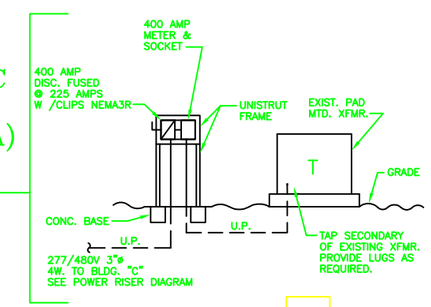
FREE STANDING UNISTRUT MTD. METER & DISCONNECT

CONCRETE ENCASE UNDER ROADWAY TO EXTEND 10'-0" BEYOND. PROVIDE ONE SPARE CONDUIT OF SAME SIZE UNDER ROADWAYS. (TYPICAL)



BUILDING "C" POWER RISER DIAGRAM

NO SCALE



SHEET INDEX

REFERENCE:

BACKGROUND MAPPING OBTAINED FROM
RICHARD CATLIN ASSOCIATES INC.
CONTRACT NO. N62470-93-4020
"BUILDING 4075 PIPELINE SITE REMEDIATION FINAL SUBMITTAL"
MARINE CORPS AIR STATION, CHERRY POINT, N.C.,
FEBRUARY 28, 1996

GRAPHIC SCALE
IF THIS DRAWING IS A REDUCTION, USE GRAPHIC SCALE
0 60 120 180 240
1" = 60'-0"

REVISIONS

APPROVED	DATE	DESCRIPTION	SYM.

EFD
CONTRACTOR
DESIGN
DRAWN
CHIEF ARCH./ ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

McLaren Hart

A/E CONTRACT NO.
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ACTIVITY - SATISFACTORY TO
APPROVED
DATE
DATE
FOR EFD FOR COMMANDER NAVFAC
SEAL

DEPARTMENT OF THE NAVY
NAVAL STATION
MARINE CORPS AIR STATION
ATLANTIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
NORFOLK, VIRGINIA
CHERRY POINT, NORTH CAROLINA

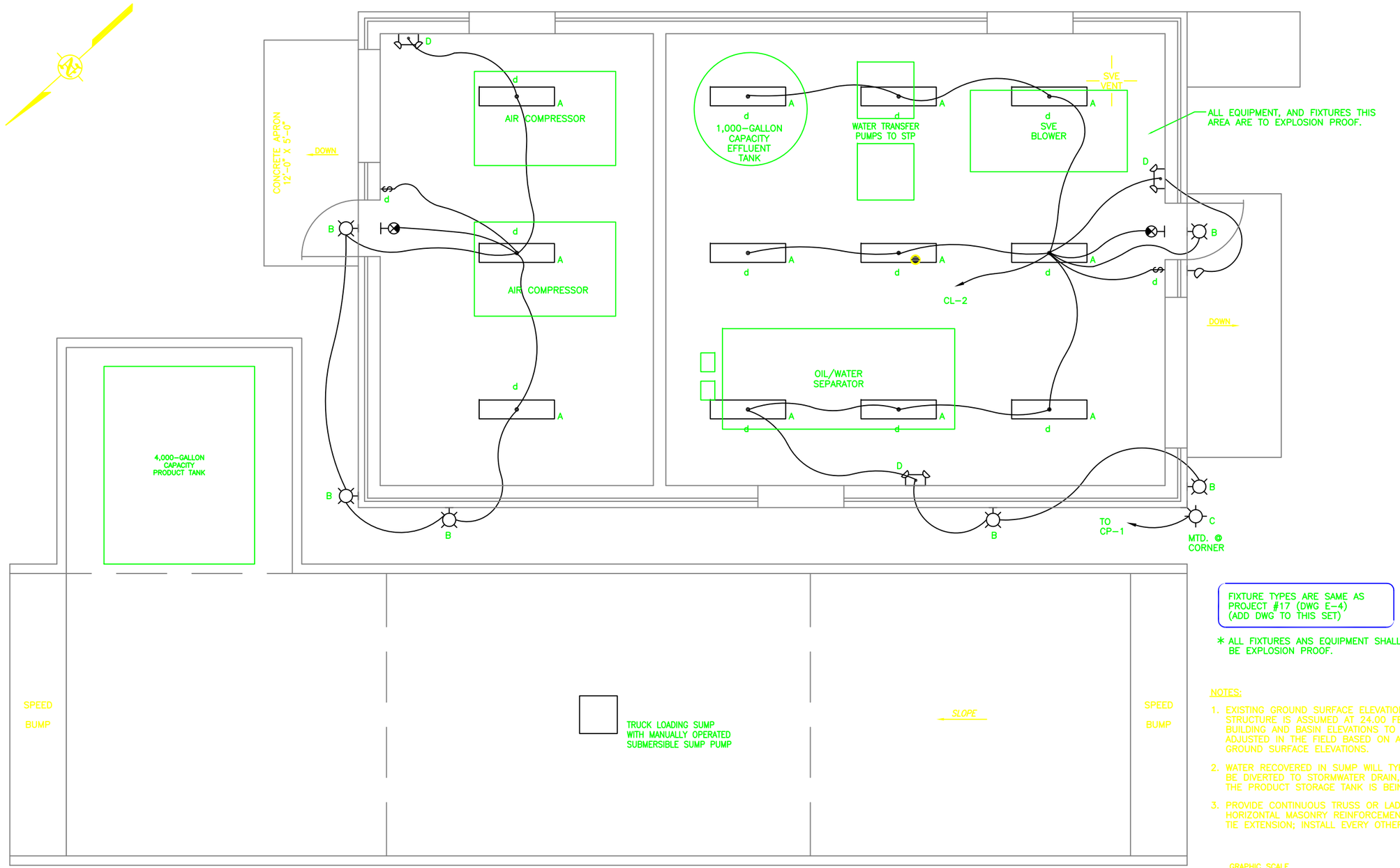
BUILDING 4075 PIPELINE SITE REMEDIATION

"AS-BUILT" - TREATMENT BUILDING C - ELECTRICAL SITE PLAN

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO.
N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 35 OF 38

E-4

SNO G:\CAD\DWG\JA033\JA33201B4 -FEB2,2001 12:00AM PLOT: 1=60



FIXTURE TYPES ARE SAME AS
PROJECT #17 (DWG E-4)
(ADD DWG TO THIS SET)

* ALL FIXTURES ANS EQUIPMENT SHALL
BE EXPLOSION PROOF.

NOTES:

1. EXISTING GROUND SURFACE ELEVATION NEAR STRUCTURE IS ASSUMED AT 24.00 FEET. BUILDING AND BASIN ELEVATIONS TO BE ADJUSTED IN THE FIELD BASED ON ACTUAL GROUND SURFACE ELEVATIONS.
2. WATER RECOVERED IN SUMP WILL TYPICALLY BE DIVERTED TO STORMWATER DRAIN, UNLESS THE PRODUCT STORAGE TANK IS BEING EMPTIED.
3. PROVIDE CONTINUOUS TRUSS OR LADDER TYPE HORIZONTAL MASONRY REINFORCEMENT WITH BRICK TIE EXTENSION; INSTALL EVERY OTHER COURSE.

GRAPHIC SCALE
IF THIS DRAWING IS A REDUCTION,
USE GRAPHIC SCALE

3/8" = 1'-0"

1 0 1 2 3 4 5 10

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

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DEPARTMENT OF THE NAVY
NAVAL STATION
MARINE CORPS AIR STATION
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
CHERRY POINT NORTH CAROLINA

BUILDING 4075 PIPELINE SITE REMEDIATION

"AS-BUILT" - TREATMENT BUILDING C - LIGHTING PLAN

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO.
N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 36 OF 38

E-5

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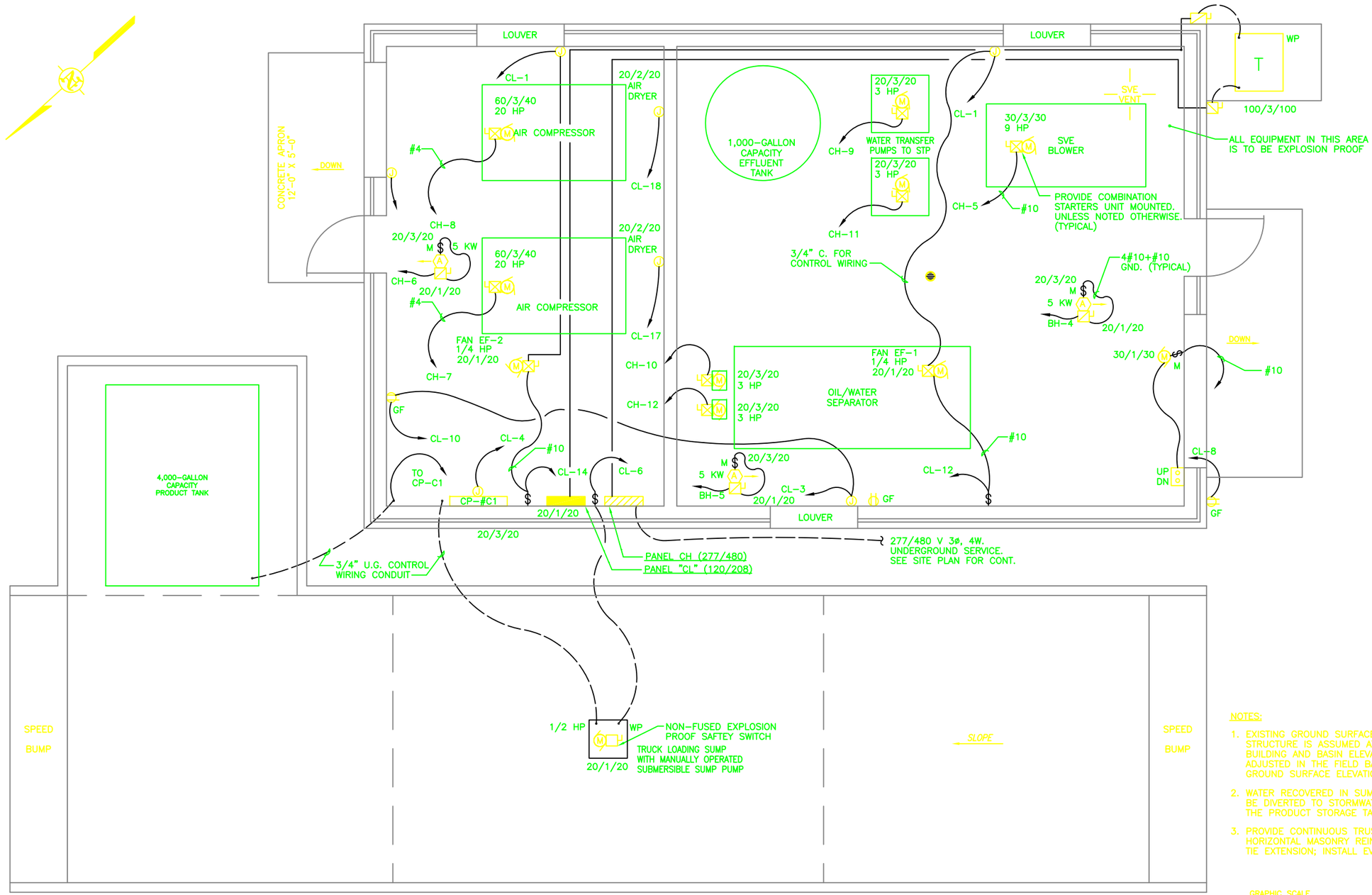

NOTES:

1. EXISTING GROUND SURFACE ELEVATION NEAR STRUCTURE IS ASSUMED AT 24.00 FEET. BUILDING AND BASIN ELEVATIONS TO BE ADJUSTED IN THE FIELD BASED ON ACTUAL GROUND SURFACE ELEVATIONS.
2. WATER RECOVERED IN SUMP WILL TYPICALLY BE DIVERTED TO STORMWATER DRAIN, UNLESS THE PRODUCT STORAGE TANK IS BEING EMPTIED.
3. PROVIDE CONTINUOUS TRUSS OR LADDER TYPE HORIZONTAL MASONRY REINFORCEMENT WITH BRICK TIE EXTENSION; INSTALL EVERY OTHER COURSE.

GRAPHIC SCALE
IF THIS DRAWING IS A REDUCTION, USE GRAPHIC SCALE
3/8" = 1'-0"
1 0 1 2 3 4 5 10

REVISIONS

DESCRIPTION	DATE	APPROVED

CONTRACTOR EFD
DESIGN
DRAWN
REVIEW
CHIEF ARCH/ ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR
SIGN.

McLaren Hart

A/E CONTRACT NO. DATE
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FOR EFD FOR COMMANDER RWPAC
SIGN.

DEPARTMENT OF THE NAVY
NAVAL STATION
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

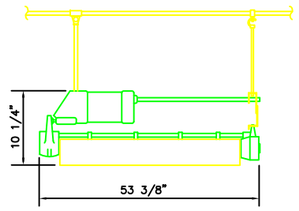
BUILDING 4075 PIPELINE SITE REMEDIATION

"AS-BUILT" - TREATMENT BUILDING C - WIRING PLAN

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 37 OF 38

E-6

SNO G:\CAD\DWG\0832\08320186 FEB2,2001 12:00AM PLOT: 1=32



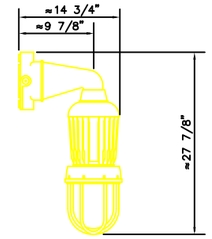
LUMINAIRE REQUIREMENTS

1. LUMINAIRE SHALL MEET UL 844 OR FACTORY MUTUAL (FM) STANDARD FOR CLASS 1, DIVISION 1, GROUP D HAZARDOUS LOCATIONS, AND UL 595. UL LISTED FOR DAMP AND WET LOCATIONS.
2. HOUSING SHALL BE COPPER FREE CAST ALUMINUM WITH LACQUER OR EPOXY FINISH. PROVIDE EXTERNAL MOUNTING LUGS.
3. ALL JOINTS SHALL BE OF THE THREADED TYPE.
4. MOUNTING AS INDICATED.
5. PROVIDE INTERNAL GREEN GROUNDING SCREW.
6. LUMINAIRE SHALL BE COMPLETELY FACTORY PREWIRED.
7. LUMINAIRE SHALL BE SUITABLE FOR PENDANT OR SURFACE MOUNTING.
8. LUMINAIRE SHALL HAVE SPRING LOADED LAMP SOCKETS.
9. PROVIDE TWO F032 T8 FLUORESCENT LAMPS MOUNTED IN HEAVY DUTY GLASS TUBES WITH THREADED COVERS.
10. PROVIDE SHEET ALUMINUM REFLECTORS WITH WHITE ENAMEL INSIDE FINISH AND ALUMINUM LACQUER FINISH OUTSIDE.
11. BALLAST SHALL BE HIGH POWER FACTOR (0.95) INSTANT START CLASS P INTEGRAL ELECTRONIC WITH A SOUND RATING OF "A".
12. STAINLESS STEEL EXPOSED HARDWARE.

A — EXPLOSION-PROOF FLUORESCENT LIGHTING FIXTURE, TYPE A

E2 E4

NOT TO SCALE



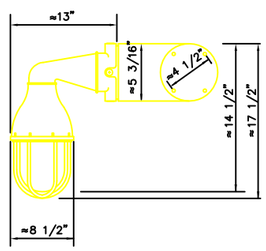
LUMINAIRE REQUIREMENTS

1. LUMINAIRE SHALL MEET UL 844 OR FACTORY MUTUAL (FM) STANDARD FOR CLASS 1, DIVISION 1, GROUP D HAZARDOUS LOCATIONS. UL LISTED FOR DAMP AND WET LOCATIONS.
2. HOUSING AND GLOBE GUARD SHALL BE COPPER FREE CAST ALUMINUM WITH LACQUER OR EPOXY FINISH. PROVIDE EXTERNAL MOUNTING LUGS.
3. ALL JOINTS SHALL BE OF THE THREADED TYPE.
4. MOUNTING AS INDICATED.
5. PROVIDE INTERNAL GREEN GROUNDING SCREW.
6. LUMINAIRE SHALL BE COMPLETELY FACTORY PREWIRED.
7. ONE 150 WATT HIGH PRESSURE SODIUM LAMP.
8. HEAT AND IMPACT RESISTANT GLASS GLOBE WITH CAST GUARD. GLOBE SHALL BE INTERNALLY FLUTED TO REDUCE GLARE AND PROVIDE COMFORTABLE VIEWING LIGHT.
9. 120 VOLT AC OPERATION WITH HPF (90 PERCENT MIN.) INTEGRAL ENCASED AND POTTED BALLAST.
10. WEATHER RESISTANT GASKETED CONSTRUCTION SUITABLE FOR WET LOCATIONS.
11. STAINLESS STEEL EXPOSED HARDWARE.

B — EXPLOSION-PROOF EXTERIOR H.I.D. LIGHTING FIXTURE, TYPE B

E2 E4

NOT TO SCALE



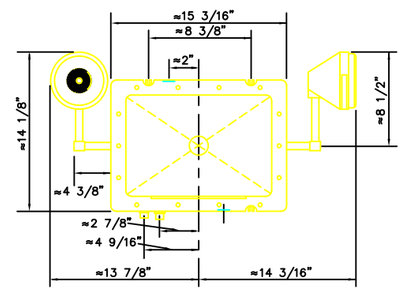
LUMINAIRE REQUIREMENTS

1. LUMINAIRE SHALL MEET UL 844 OR FACTORY MUTUAL (FM) STANDARD FOR CLASS 1, DIVISION 1, GROUP D HAZARDOUS LOCATIONS. UL LISTED FOR DAMP AND WET LOCATIONS.
2. HOUSING AND GLOBE GUARD SHALL BE COPPER FREE CAST ALUMINUM WITH LACQUER OR EPOXY FINISH. PROVIDE EXTERNAL MOUNTING LUGS.
3. ALL JOINTS SHALL BE OF THE THREADED TYPE.
4. MOUNTING AS INDICATED.
5. PROVIDE INTERNAL GREEN GROUNDING SCREW.
6. LUMINAIRE SHALL BE COMPLETELY FACTORY PREWIRED.
6. ONE 250 EFFECTIVE CANDLEPOWER STROBE LAMP PROVIDING A PEAK FLASH OF 3.375 MILLION CANDLEPOWER WITH 180 DEGREE DISPERSION IN ALL AXES.
7. RED POLYCARBONATE LENS, HEAT AND IMPACT RESISTANT GLASS GLOBE WITH CAST GUARD.
8. 120 VOLT AC OPERATION WITH SOLID STATE POWER SUPPLY PROVIDING 72 FLASHES PER MINUTE.
9. WEATHER RESISTANT, GASKETED CONSTRUCTION.
10. STAINLESS STEEL EXPOSED HARDWARE.

C — EXPLOSION-PROOF LIGHTING FIXTURE, TYPE C

E2 E4

NOT TO SCALE



LUMINAIRE REQUIREMENTS

1. LUMINAIRE SHALL MEET UL 844 OR FACTORY MUTUAL (FM) STANDARD FOR CLASS 1, DIVISION 1, GROUP D HAZARDOUS LOCATIONS, AND UL 924. UL LISTED FOR DAMP AND WET LOCATIONS.
2. HOUSING SHALL BE COPPER FREE CAST ALUMINUM WITH LACQUER OR EPOXY FINISH. PROVIDE EXTERNAL MOUNTING LUGS.
3. ALL JOINTS SHALL BE OF THE THREADED TYPE. HOUSING COVER SHALL HAVE GROUND JOINT WITH EXTERNAL BOLTED FLANGE.
4. MOUNTING AS INDICATED.
5. PROVIDE INTERNAL GREEN GROUNDING SCREW.
6. LUMINAIRE SHALL BE COMPLETELY FACTORY PREWIRED.
7. TWO 12 VOLT, 12 WATT TUNGSTEN HALOGEN FIXTURE ASSEMBLIES SHALL BE FULLY ADJUSTABLE AND LOCKABLE ON TWO AXES.
8. "PUSH-TO-TEST" SWITCH.
9. "MAIN POWER ON" PILOT LIGHT.
10. NICKEL CADMIUM BATTERY SHALL PROVIDE 90 MINUTES OF ILLUMINATION. SOLID STATE BATTERY CHARGER. 120 VOLT OPERATION.
11. STAINLESS STEEL EXPOSED HARDWARE

D — EXPLOSION-PROOF EMERGENCY LIGHTING FIXTURE, TYPE D

E2 E4

NOT TO SCALE

DRAWING NOT TO SCALE

REFERENCE:

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. (BY McFADYEN O'BRIANT CONSULTING ENGINEERING, INC.) DRAWING TITLED, "LIGHTING FIXTURE DETAILS" FOR SUBSURFACE PETROLEUM REMEDIATION, BLDG 130/ BLDG 3996/PIT 4 AREA, PRELIMINARY, DRAWING E-7, SHEET 29 OF 30, FILENAME: 9550E7.DWG. SCALE: 1 = 1.

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

CONTRACTOR | EFD | DESIGN | DRAWN | CHIEF | CHIEF ARCH / ENGR. | PROJECT MANAGER | FIRE PROTECTION | QUALITY CONTROL | BRANCH MANAGER | DESIGN DIRECTOR

McLaren Hart

A/E CONTRACT NO. | DATE
APPROVED
ACTIVITY - SATISFACTORY TO | DATE
APPROVED
FOR EFD FOR COMMANDER SWFAC

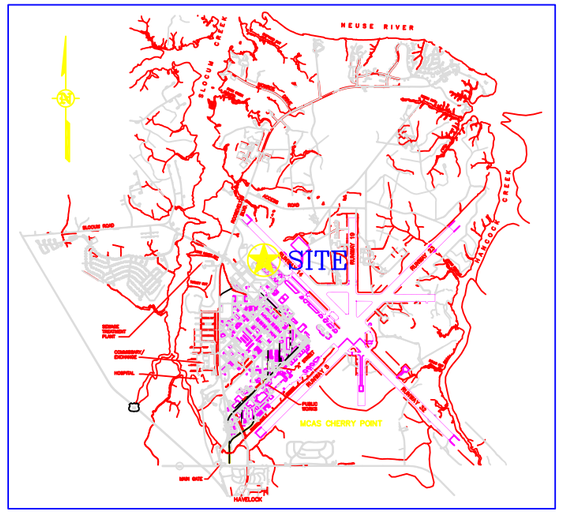
SEAL

DEPARTMENT OF THE NAVY
NAVAL STATION
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION CHERRY POINT NORTH CAROLINA
BUILDING 4075 PIPELINE SITE REMEDIATION
"AS-BUILT" - LIGHTING FIXTURE DETAILS

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945832
SPEC. NO.
CONSTR. CONTR. NO.
N62470-93-C-D-3033
NAVFAC DRAWING NO.
SHEET 38 OF 38

E-7

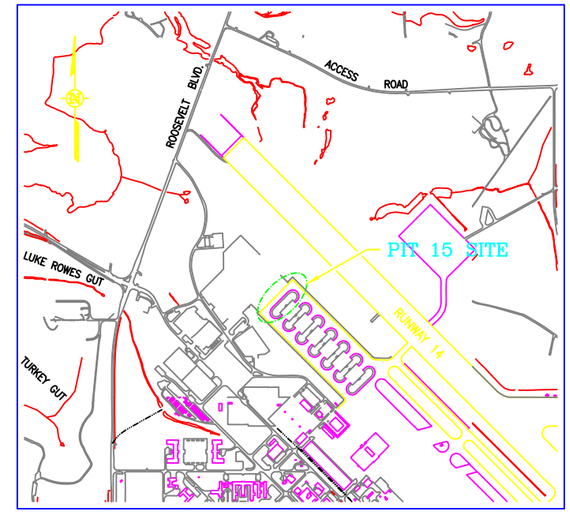
SNO G:\CAD\DWG\0830\0830\80167 APR22,2000 12:00AM



VICINITY MAP

NOT TO SCALE

REFERENCE:
LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC., RALEIGH, NORTH CAROLINA DRAWING TITLED, "VICINITY MAP, PIT 15, CHERRY POINT MCAS, HAVELOCK, NORTH CAROLINA", MCAS CAD FILES, FILE 0041_1.DWG, DRAWING NUMBER 1, DATE: 8/12/98. SCALE: NOT TO SCALE.



LOCATION MAP

NOT TO SCALE

REFERENCE:
LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC., RALEIGH, NORTH CAROLINA DRAWING TITLED, "VICINITY MAP, PIT 15, CHERRY POINT MCAS, HAVELOCK, NORTH CAROLINA", MCAS CAD FILES, FILE 0041_1.DWG, DRAWING NUMBER 1, DATE: 8/12/98. SCALE: NOT TO SCALE.

CONSTRUCTION CONTRACT NO. N62470-93-D-3033

PIT 15 SITE REMEDIATION

"AS-BUILT" DRAWING PACKAGE

MARINE CORPS AIR STATION CHERRY POINT, NORTH CAROLINA

INDEX OF DRAWINGS

SHEET NO.	SHEET TITLE	NAVFAC DWG. NO.
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C-1	UTILITY PLAN	
C-2	INSTALLATION PLAN	
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E-1	ELECTRICAL SITE PLAN	
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DRAWING NOT TO SCALE

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

CONTRACTOR
EFD
DESIGN
CHECKED
REVIEW
CHIEF ARCH./ ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

JA JONES

A/E CONTRACT NO.
APPROVED DATE
ACTIVITY - SATISFACTORY TO
APPROVED DATE
FOR EFD FOR COMMANDER NAVFAC
SEAL

DEPARTMENT OF THE NAVY
NAVAL STATION
MARINE CORPS AIR STATION
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
CHERRY POINT, NORTH CAROLINA
PIT 15 SITE REMEDIATION
"AS-BUILT" - TITLE SHEET

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945858
SPEC. NO.
CONSTR. CONTR. NO.
N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 1 OF 14
T-1

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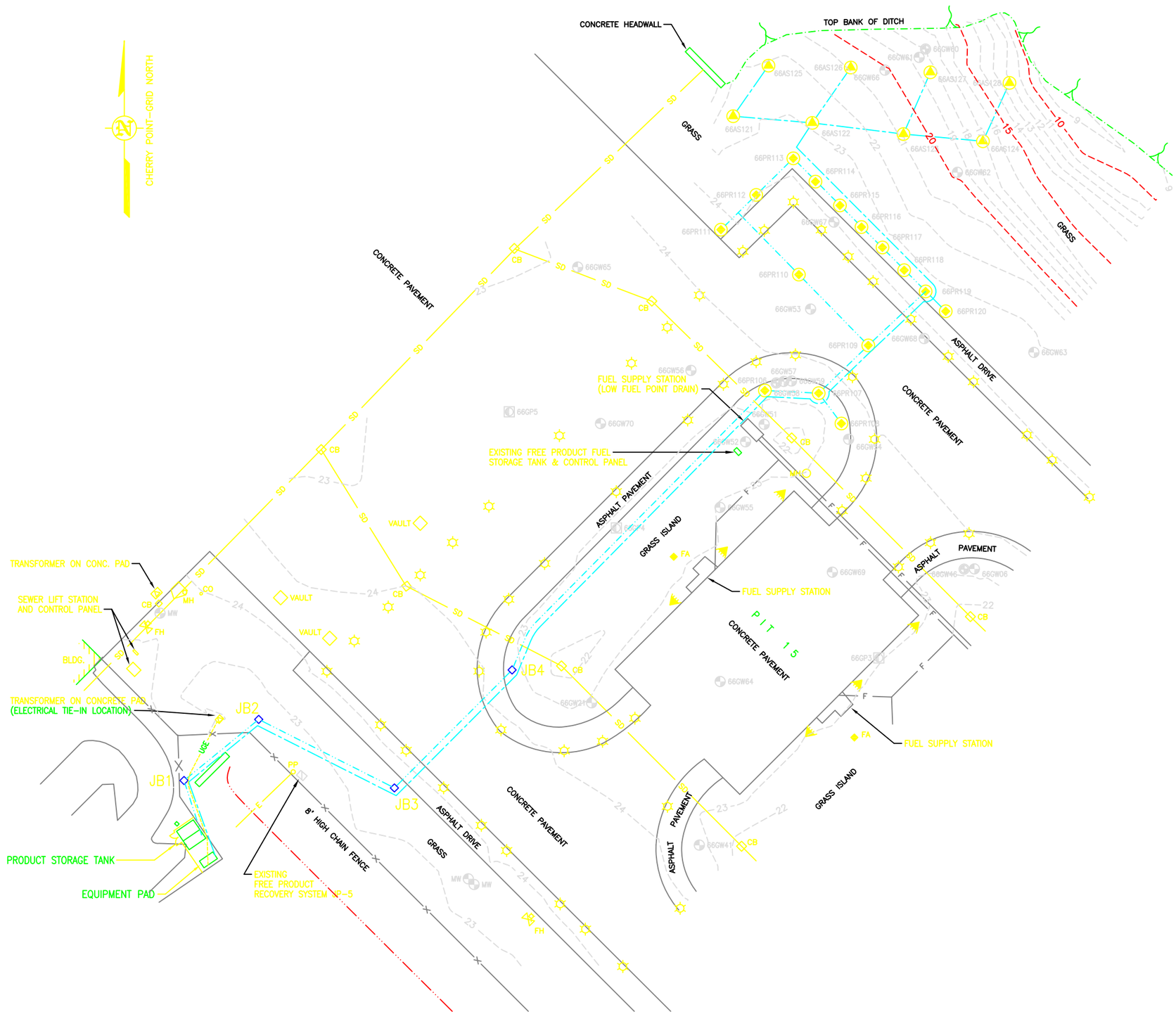

LEGEND

- BUILDING
- CONTOUR INTERVAL
- POWER LINE W/POLE
- ACTIVE PIPELINE
- STORM DRAINAGE PIPE
- FIRE HYDRANT
- WATER VALVE
- FIRE ALARM
- CATCH BASIN
- MANHOLE
- TRANSFORMER
- TAXIWAY LIGHT
- WORK FLOOD LIGHT
- TYPE II WELL
- TYPE III WELL
- GEOPROBE POINT
- SPARGE WELL LOCATION
- RECOVERY WELL LOCATION
- SPARGE PIPE
- RECOVERY, AIR SUPPLY, AND SECONDARY CONTAINMENT PIPE
- UNDERGROUND ELECTRIC SERVICE
- 8-FOOT HIGH CHAIN FENCE
- SWALE

REFERENCES:

1. BASE DRAWING:
LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. DRAWING TITLED, "SUBSURFACE PETROLEUM REMEDIATION, PIT 15, MARINE CORPS BASE, CHERRY POINT, NORTH CAROLINA," DRAWING NUMBER 2, JOB: 30740-6-0600, CAD FILE: 0041_2.DWG, DATED: 10/5/98. SCALE: 1"=100'.

2. WELL LOCATIONS:
WELLS 66PR106 THRU 120 AND 66AS121 THRU 128: JOHN L. PIERCE & ASSOCIATES, P.A. OF N.C. DRAWING TITLED, "PIT 15 SITE REMEDIATION, HORIZONTAL AND VERTICAL SURVEY," JOB #216490, DATE: MARCH 1, 2001, SCALE: 1"=50'.

GRAPHIC SCALE
IF THIS DRAWING IS A REDUCTION, USE GRAPHIC SCALE

1" = 50'-0" 0 50 100 150 200

REVISIONS

DESCRIPTION	DATE	APPROVED
FINAL		

CONTRACTOR EFD
DESIGN
DRAWN
CHIEF ACIV / ENG.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

JA JONES

A/E CONTRACT NO.
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SEAL

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NAVAL STATION
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

PIT 15 SITE REMEDIATION

"AS-BUILT" - UTILITY PLAN

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945858
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 2 OF 14

C-1

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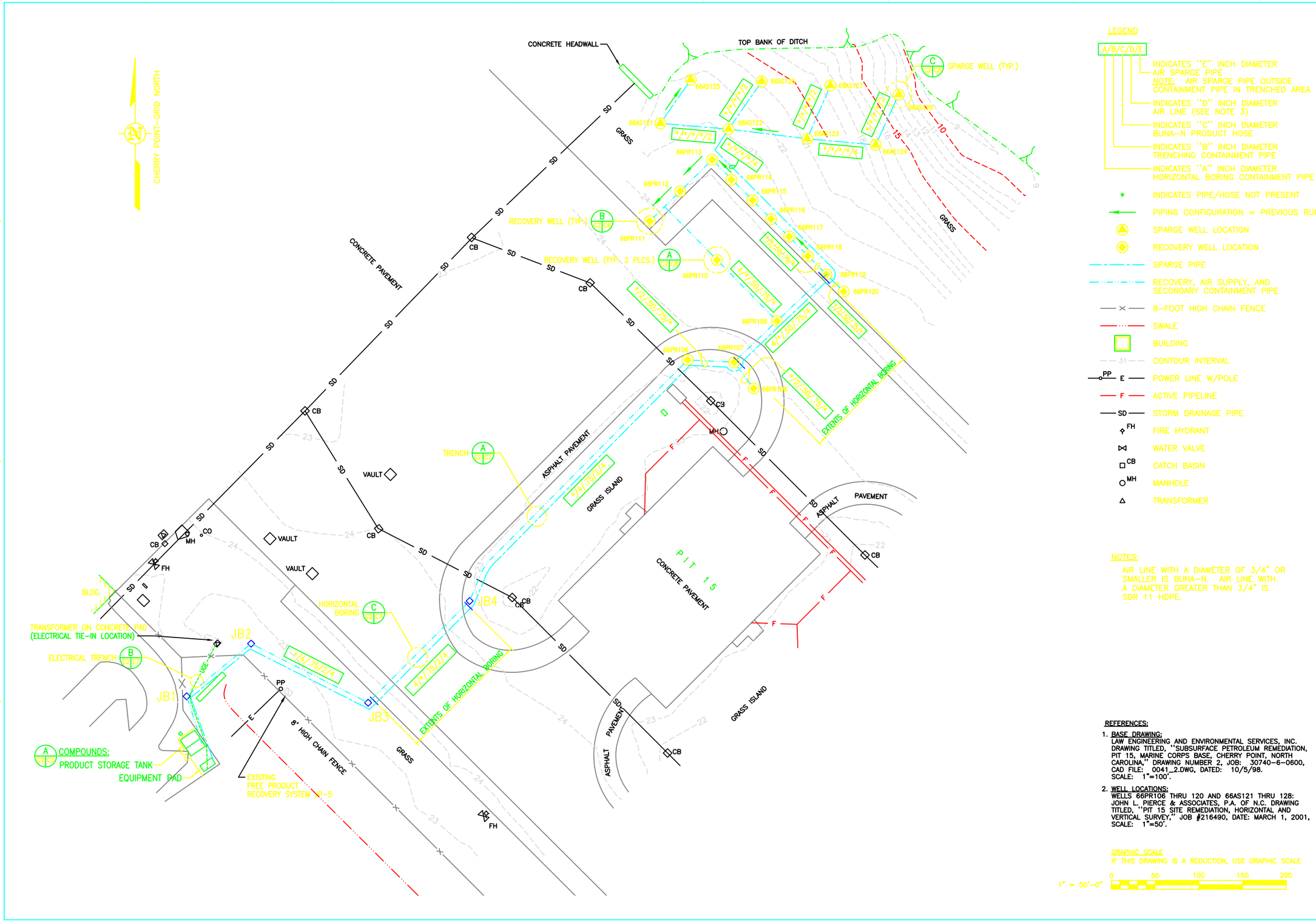

LEGEND

A/B/C/D/E
- INDICATES "E" INCH DIAMETER AIR SPARGE PIPE
  NOTE: AIR SPARGE PIPE OUTSIDE CONTAINMENT PIPE IN TRENCHED AREA
- INDICATES "D" INCH DIAMETER AIR LINE (SEE NOTE 3)
- INDICATES "C" INCH DIAMETER BUNA-N PRODUCT HOSE
- INDICATES "B" INCH DIAMETER TRENCHING CONTAINMENT PIPE
- INDICATES "A" INCH DIAMETER HORIZONTAL BORING CONTAINMENT PIPE

* INDICATES PIPE/HOSE NOT PRESENT

PIPING CONFIGURATION = PREVIOUS RUN

SPARGE WELL LOCATION

RECOVERY WELL LOCATION

SPARGE PIPE

RECOVERY, AIR SUPPLY, AND SECONDARY CONTAINMENT PIPE

8-FOOT HIGH CHAIN FENCE

SWALE

BUILDING

31 CONTOUR INTERVAL

PP E POWER LINE W/POLE

F ACTIVE PIPELINE

SD STORM DRAINAGE PIPE

FH FIRE HYDRANT

WATER VALVE

CB CATCH BASIN

MH MANHOLE

TRANSFORMER

NOTES:

AIR LINE WITH A DIAMETER OF 3/4" OR SMALLER IS BUNA-N. AIR LINE WITH A DIAMETER GREATER THAN 3/4" IS SDR 11 HDPE.

REFERENCES:

1. BASE DRAWING:
   LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. DRAWING TITLED, "SUBSURFACE PETROLEUM REMEDIATION, PIT 15, MARINE CORPS BASE, CHERRY POINT, NORTH CAROLINA," DRAWING NUMBER 2, JOB: 30740-6-0600, CAD FILE: 0041_2.DWG, DATED: 10/5/98. SCALE: 1"=100'.
2. WELL LOCATIONS:
   WELLS 66PR106 THRU 120 AND 66AS121 THRU 128: JOHN L. PIERCE & ASSOCIATES, P.A. OF N.C. DRAWING TITLED, "PIT 15 SITE REMEDIATION, HORIZONTAL AND VERTICAL SURVEY," JOB #216490, DATE: MARCH 1, 2001, SCALE: 1"=50'.

GRAPHIC SCALE
IF THIS DRAWING IS A REDUCTION, USE GRAPHIC SCALE

1" = 50'-0" 0 50 100 150 200

REVISIONS

APPROVED	DATE	DESCRIPTION	SYM.

CONTRACTOR / EFD DESIGN MANAGER / DESIGN MANAGER / CHIEF ARCH./ ENGR. / PROJECT MANAGER / FIRE PROTECTION / QUALITY CONTROL / BRANCH MANAGER / DESIGN DIRECTOR

JA JONES

A/E CONTRACT NO. / APPROVED / DATE

ACTIVITY - SATISFACTORY TO / APPROVED / DATE

FOR EFD FOR COMMANDER RWMC

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NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

PIT 15 SITE REMEDIATION

"AS-BUILT" - INSTALLATION PLAN

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945858
SPEC. NO.
CONSTR. CONTR. NO. N62470-99-D-3033
NAVFAC DRAWING NO.
SHEET 3 OF 14

C-2

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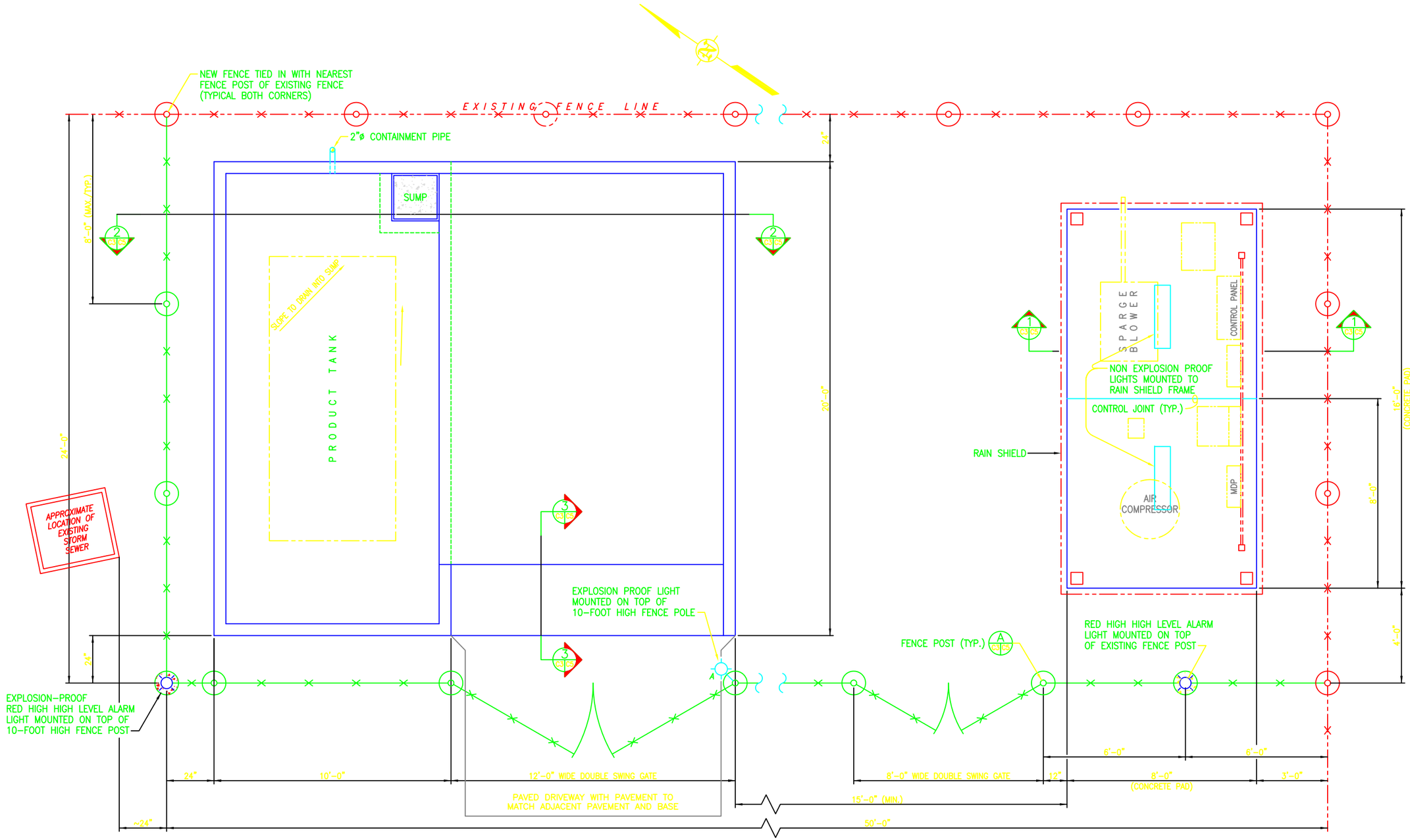

PRODUCT STORAGE TANK PAD
CLASS I, DIVISION II, GROUP D (SEE NOTE 2)

EQUIPMENT PAD
UNCLASSIFIED
(REFER TO C-4 FOR EQUIPMENT LAYOUT)

A/C2|C3 COMPOUND PLAN

SCALE: 1" = 2'-0"

NOTES:

1. ALL FENCE POSTS ARE 8 FEET IN HEIGHT, UNLESS OTHERWISE NOTED.
2. THE AREA WITHIN 12 FEET OF THE CONTAINMENT PAD IS CONSIDERED CLASS I, DIVISION II, GROUP D ZONE. ALL ELECTRICAL EQUIPMENT WITHIN THIS ZONE IS RATED FOR USE IN HAZARDOUS ATMOSPHERES.

GRAPHIC SCALE
IF THIS DRAWING IS A REDUCTION, USE GRAPHIC SCALE
1" = 2'-0" 0 1 2 4 6 8

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

CONTRACTOR EFD
DESIGN
DRAWN
REVIEW
CHIEF ARCH./ ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
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J.A. JONES

A/E CONTRACT NO. DATE
APPROVED
ACTIVITY - SATISFACTORY TO DATE
APPROVED
FOR EFD FOR COMMANDER NAVFAC
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NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

PIT 15 SITE REMEDIATION

"AS-BUILT" - PRODUCT AND TREATMENT COMPOUND LAYOUTS

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945858
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 4 OF 14
C-3

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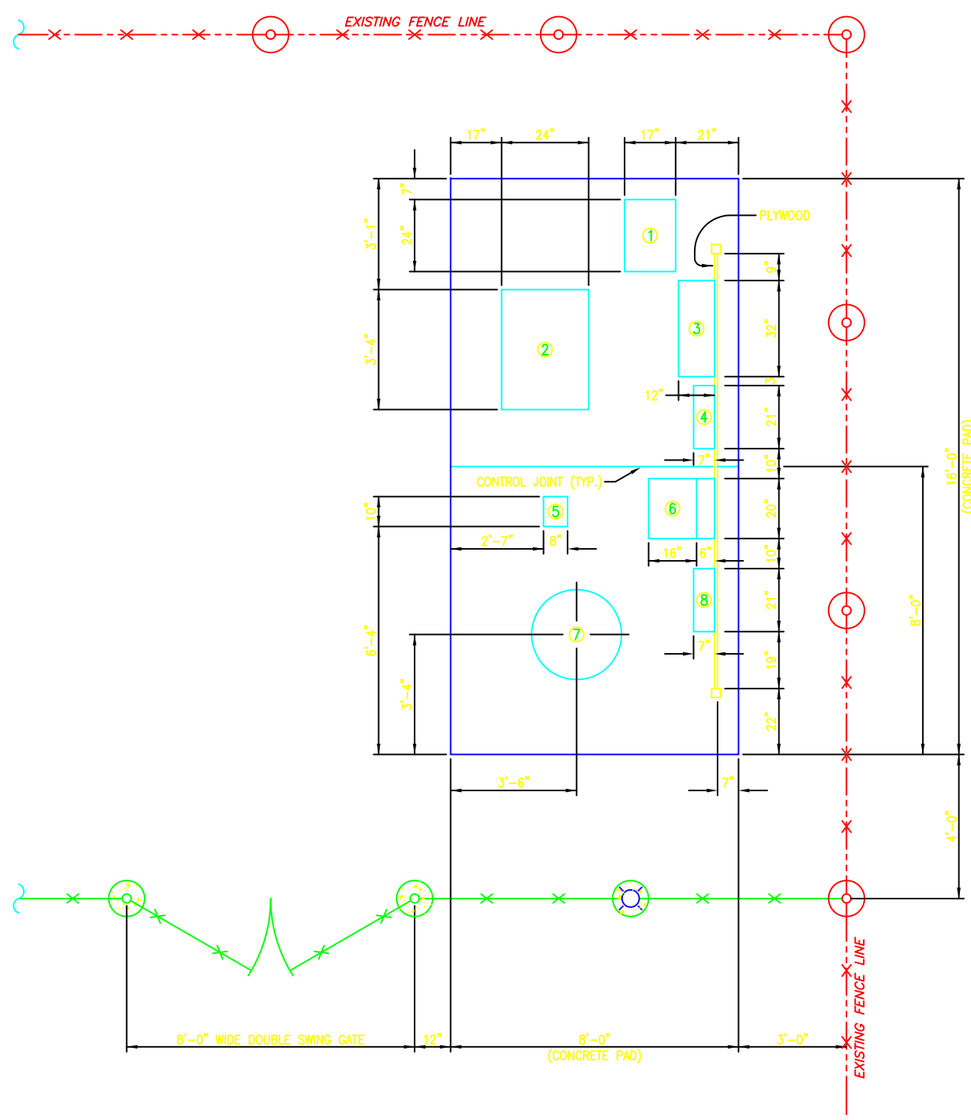

EQUIPMENT PAD LAYOUT

SCALE: 1" = 2'-0"

EQUIPMENT IDENTIFICATION

ITEM	DESCRIPTION
1	HEAT EXCHANGER
2	AIR SPARGE
3	CONTROL PANEL
4	SECONDARY
5	AIR DRYER
6	TRANSFORMER
7	30 ^{cfm} AIR COMPRESSOR
8	MAIN DISTRIBUTION PANEL

NOTE:

ALL FENCE POSTS ARE 8 FEET IN HEIGHT, UNLESS OTHERWISE NOTED.

GRAPHIC SCALE

IF THIS DRAWING IS A REDUCTION, USE GRAPHIC SCALE

1" = 2'-0" 0 1 2 4 6 8

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

CONTRACTOR EFD
DESIGN
DRAWN
CHECK
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

JA JONES

A/E CONTRACT NO.
APPROVED DATE
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SEAL

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NAVAL STATION
NAVAL FACILITIES ENGINEERING COMMAND
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NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

PIT 15 SITE REMEDIATION

"AS-BUILT" - EQUIPMENT PAD LAYOUT

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945858
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 5 OF 14

C-4

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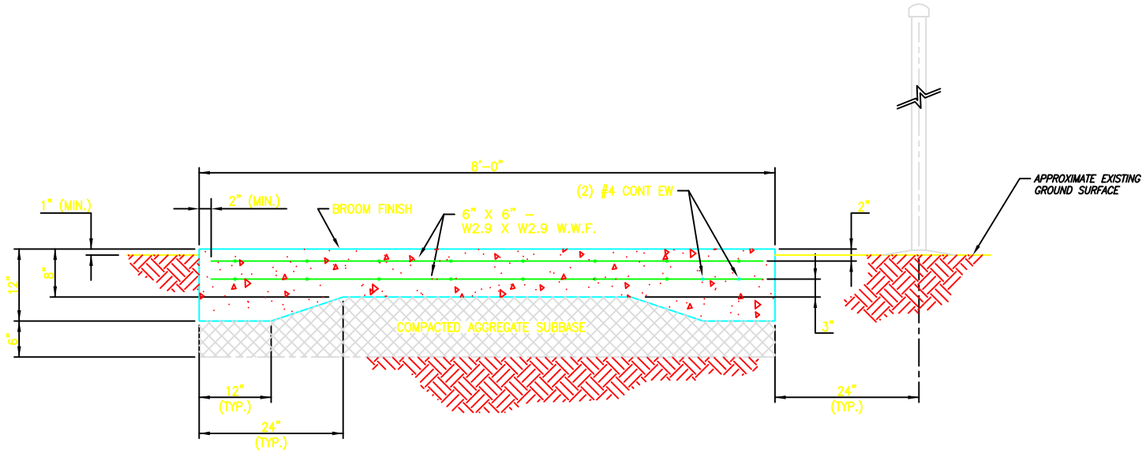
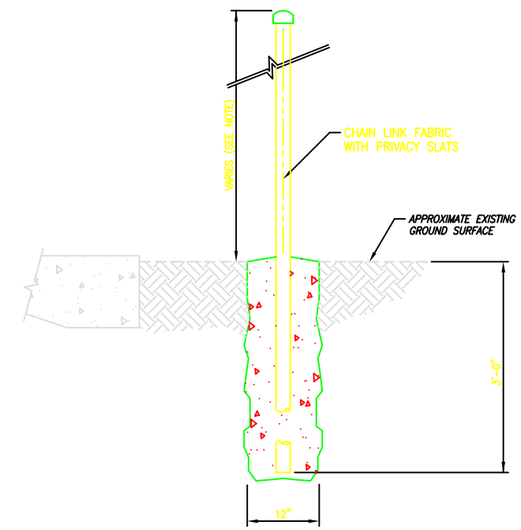


1 C3|C5 EQUIPMENT PAD

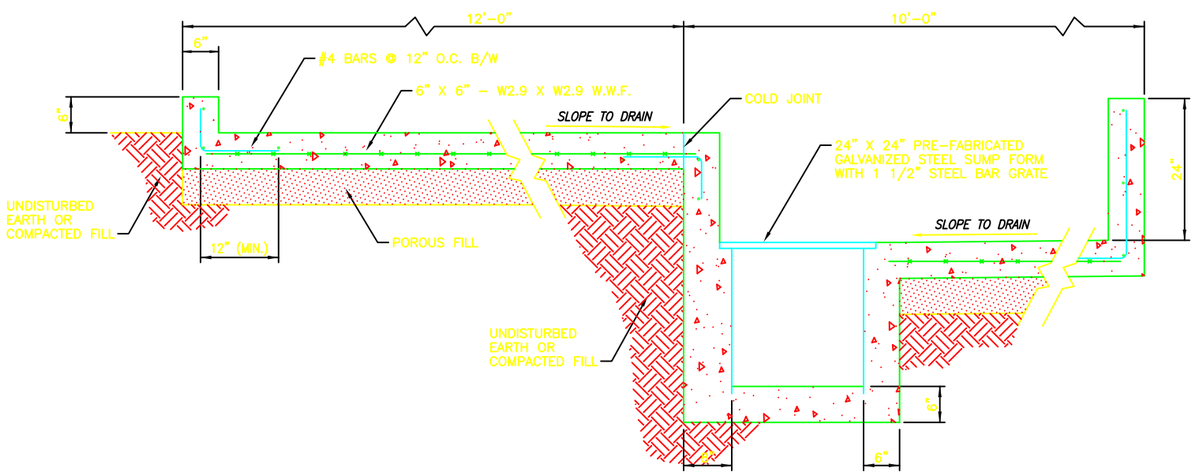
SCALE: 1" = 1'-0"



A C3|C5 FENCE POST

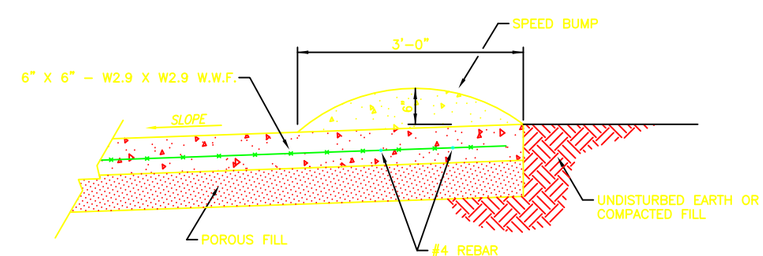
SCALE: 1" = 1'-0"

NOTE:
REFER TO DRAWING C-3 FOR FENCE POST HEIGHTS.



2 C3|C5 TRUCK-LOADING/PRODUCT PAD

SCALE: 1" = 1'-0"



3 C3|C5 SPEED BUMP DETAIL

SCALE: 1" = 1'-0"

GRAPHIC SCALE
IF THIS DRAWING IS A REDUCTION, USE GRAPHIC SCALE

1" = 1'-0" 0 1 2 3 4

REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVED

CONTRACTOR EFD
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FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

JA JONES
ENGINEERS ARCHITECTS
CONSULTANTS

A/E CONTRACT NO.
APPROVED DATE
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NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

PIT 15 SITE REMEDIATION

"AS-BUILT" – CONCRETE PAD AND FENCE DETAILS

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945858
SPEC. NO.
CONSTR. CONTR. NO.
N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 6 OF 14
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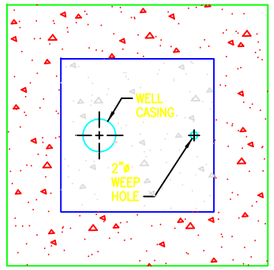
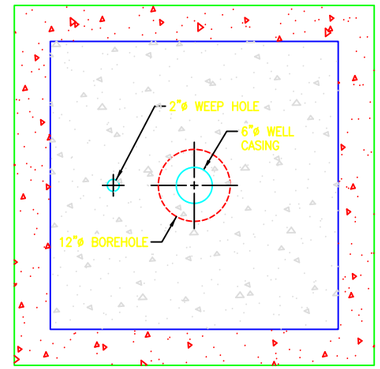


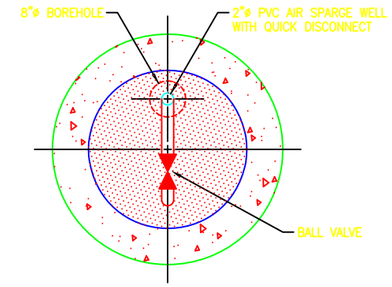
PLAN

NOTE:
INSTALLED NAMEPLATE FOR EACH WELL USING DESIGNATIONS PROVIDED BY MCAS EAD.

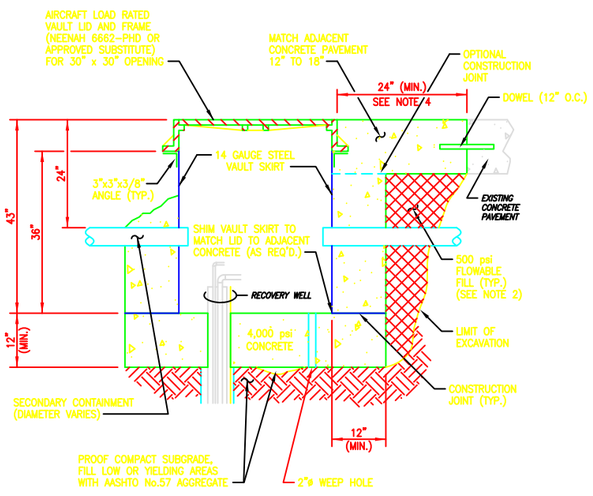


PLAN

NOTE:
INSTALLED NAMEPLATE FOR EACH WELL USING DESIGNATIONS PROVIDED BY MCAS EAD.



PLAN



ELEVATION

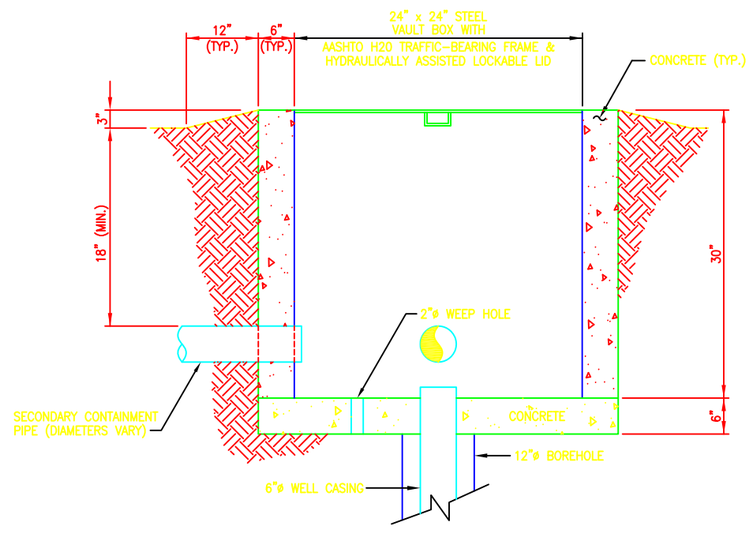
A RECOVERY WELL VAULT
AIRCRAFT LOAD RATED VAULT

NOT TO SCALE

C8 C2 C6

NOTES:

1. VAULT LIDS BEAR STAMP OF LOAD RATING.
2. ALL BACKFILL IN PAVED AREAS IS 500 psi FLOWABLE FILL. CONCRETE MAY BE USED IN LIEU OF FLOWABLE FILL.
3. VAULT SKIRT FIELD CUT TO ACCEPT PIPES. ANNULUS FORMED BETWEEN PIPE(S) AND VAULT SKIRT TO PLACE CONCRETE.
4. REMOVED ENTIRE CONCRETE SLAB TO EXISTING CONSTRUCTION JOINT. MAINTAINED 24 INCHES FROM VAULT TO PERIMETER OF SLAB.

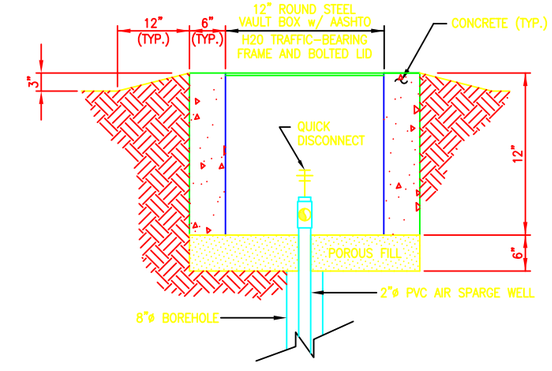


ELEVATION

B RECOVERY WELL VAULT
H20 LOAD RATED VAULT

NOT TO SCALE

C8 C2 C6



ELEVATION

C AIR SPARGE WELL VAULT

NOT TO SCALE

C9 C2 C6

DRAWING NOT TO SCALE

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

CONTRACTOR EFD
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REVIEW
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PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

JA JONES

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SEAL

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NAVAL STATION
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA

PIT 15 SITE REMEDIATION

"AS-BUILT" – WELL VAULT DETAILS

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945858
SPEC. NO.
CONSTR. CONTR. NO.
N62470-99-B-D-3033
NAVFAC DRAWING NO.
SHEET 7 OF 14
C-6

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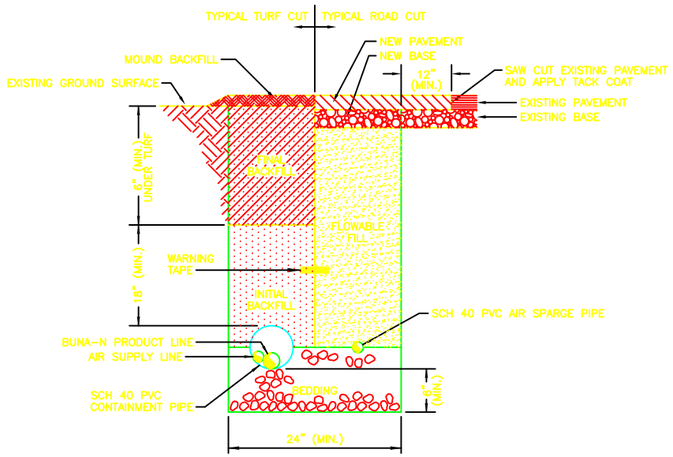


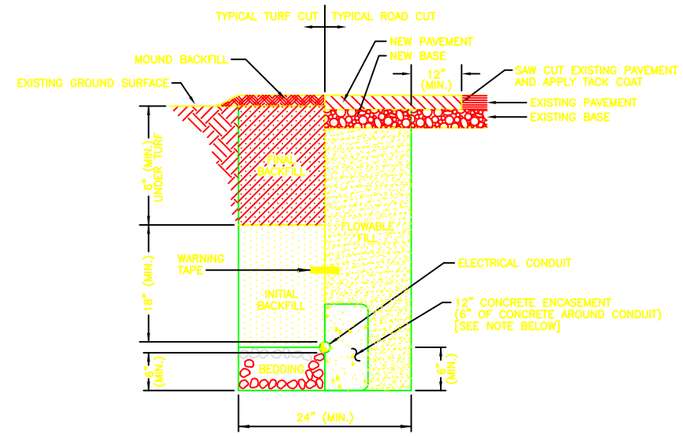
A TYPICAL TRENCH

C2 | C7

N.T.S.

NOTES:

1. NUMBER OF UTILITY LINES AND LINE DIAMETERS VARY. MAINTAINED MINIMUM CLEARANCE BETWEEN UTILITIES AND TRENCH SIDE WALLS.
2. A MINIMUM OF 6 INCHES MAINTAINED BETWEEN EACH PIPE RUN.



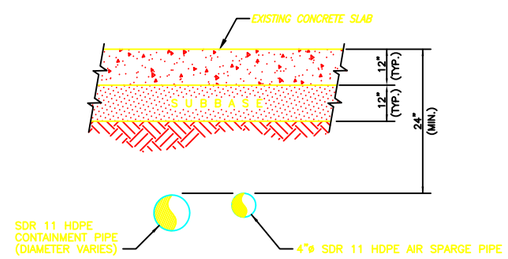
B ELECTRICAL TRENCH

C2 | C7

N.T.S.

NOTE:

PROVIDED CONCRETE ENCASEMENT BENEATH ROADWAY. EXTENDED ENCASEMENT 10 FEET BEYOND EDGE OF ROAD.



C HORIZONTAL BORING DETAIL FLIGHTLINE AREA

C2 | C7

N.T.S.

NOTES:

1. SECONDARY CONTAINMENT PIPE BORED BENEATH FLIGHTLINE.
2. CONTAINMENT PIPE BROUGHT TO WITHIN 24" BELOW THE GROUND SURFACE AT THE VAULTS.

DRAWING NOT TO SCALE

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

CONTRACTOR
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DESIGN
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JA JONES

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NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

PIT 15 SITE REMEDIATION

"AS-BUILT" - CIVIL DETAILS

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945858
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 8 OF 14
C-7

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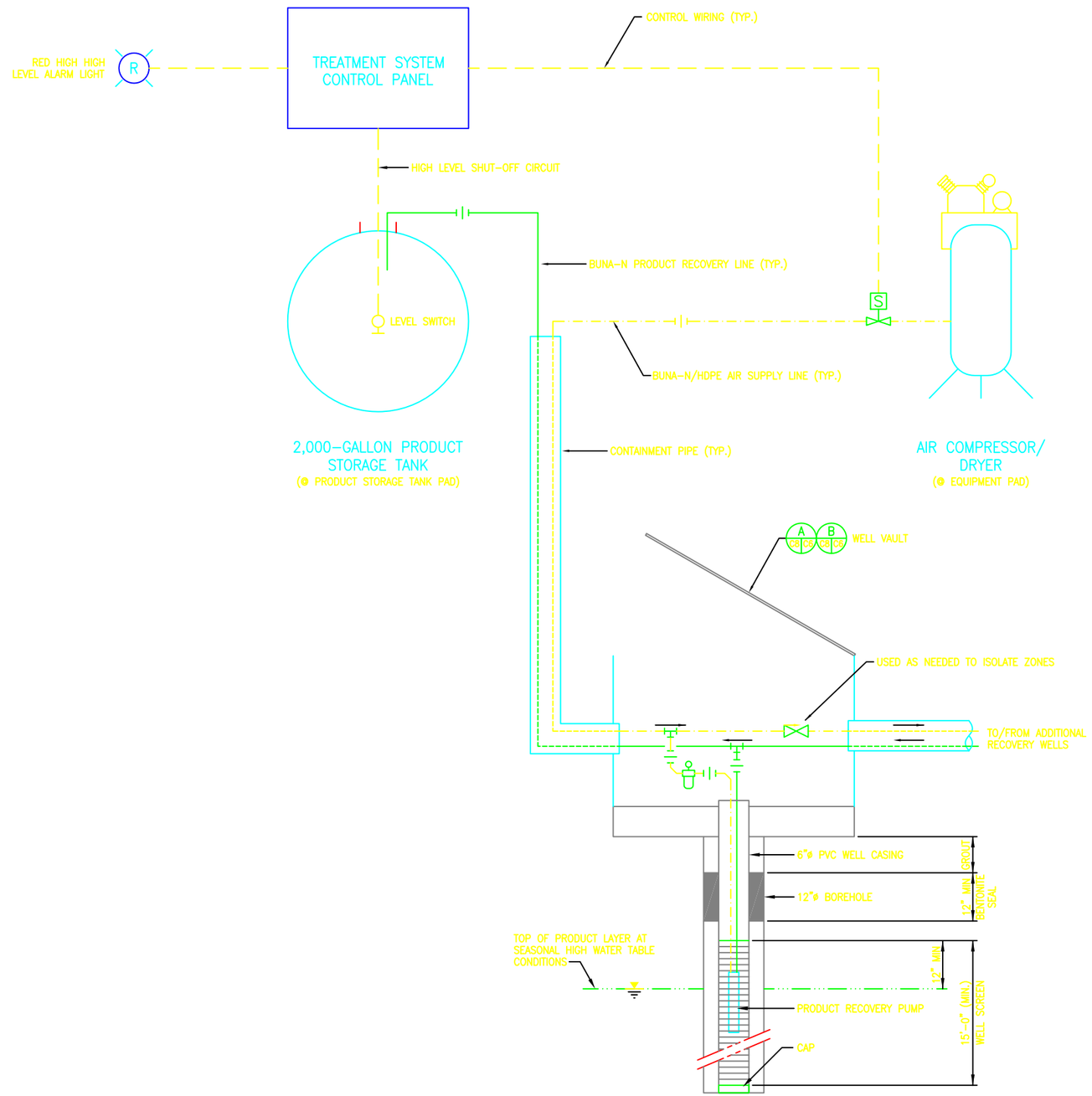

TYPICAL RECOVERY WELL

LEGEND

- CHECK VALVE
- SOLENOID VALVE
- FLOAT SWITCH
- SAMPLE TAP
- QUICK-CONNECT COUPLING
- TEE
- AIR REGULATOR

NOTE:
PRODUCT RECOVERY WELLS WERE INSTALLED AT A TOTAL DEPTH OF 25 FEET BELOW GROUND SURFACE.

DRAWING NOT TO SCALE

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

CONTRACTOR EFD
DESIGN
DRAWN
REVIEW
CHIEF ARCH/ ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

J.A. JONES

A/E CONTRACT NO.
APPROVED DATE
ACTIVITY - SATISFACTORY TO
APPROVED DATE
FOR EFD FOR COMMANDER NAVFAC
SEAL

DEPARTMENT OF THE NAVY
NAVAL STATION
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

PIT 15 SITE REMEDIATION

"AS-BUILT" - PRODUCT RECOVERY SYSTEM SCHEMATIC

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945858
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 9 OF 14
C-8

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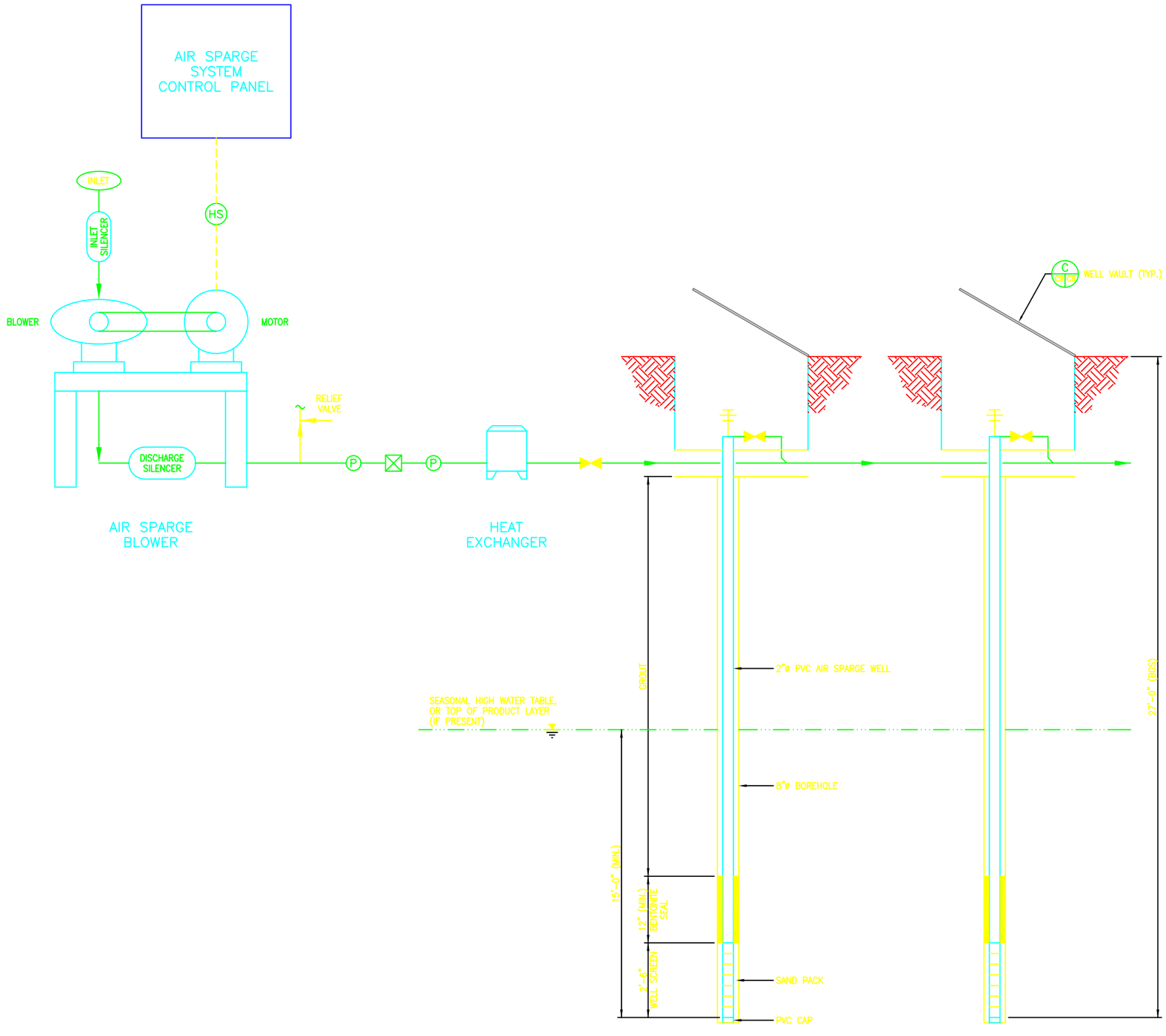

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

CONTRACTOR EFD
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CHIEF ARCH / ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

JA JONES

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NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

PIT 15 SITE REMEDIATION

"AS-BUILT" – AIR SPARGE SYSTEM SCHEMATIC

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945858
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 10 OF 14
C-9

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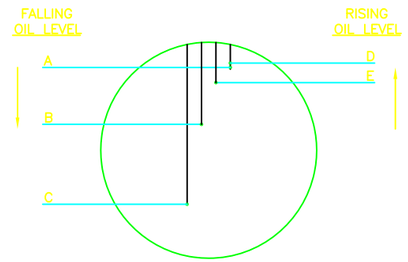
A. DEACTIVATE HIGH HIGH LEVEL ALARM: SHUT OFF PANEL AND OUTSIDE "PRODUCT TANK HIGH HIGH LEVEL" ALARM LIGHTS.

B. SHUT OFF (HIGH) PANEL.

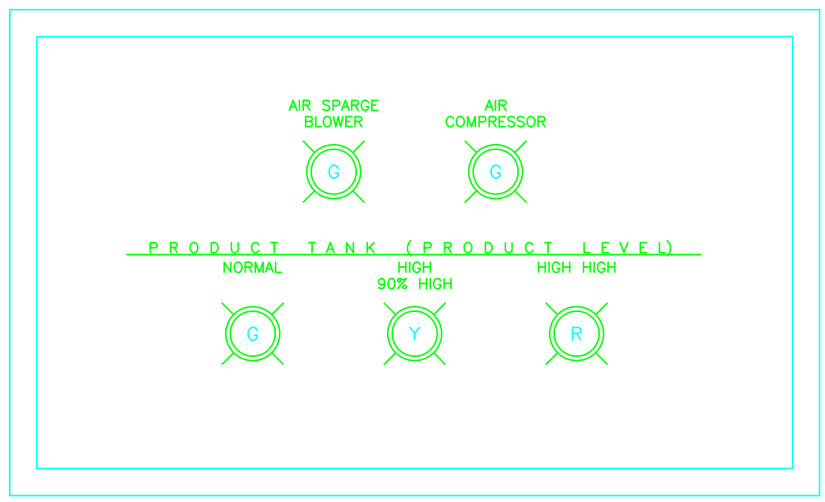
C. LOW LEVEL: TURN ON PRODUCT PUMPS BY RESTARTING THE AIR COMPRESSOR.



D. HIGH HIGH LEVEL CONDITION: SHUT OFF PRODUCT RECOVERY PUMPS BY TURNING OFF POWER TO THE AIR COMPRESSOR AND BLEEDING OFF AIR PRESSURE FROM THE AIR SUPPLY LINE AND ISOLATING AIR SUPPLY TANK OF THE AIR COMPRESSOR.

E. HIGH LEVEL CONDITION: ACTIVATE "PRODUCT TANK – HIGH" PANEL LIGHT.

PRODUCT TANK LEVEL CONTROL LOGIC



CONTROL PANEL

NOTE:
CONTROL PANEL SHALL BE CUSTOM BUILT BY MANUFACTURER AS A NEMA 4 WEATHERPROOF ENCLOSURE.

DRAWING NOT TO SCALE

REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVED

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QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR
EFD

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NAVAL FACILITIES ENGINEERING COMMAND
NAVAL STATION ATLANTIC DIVISION NORFOLK, VIRGINIA
MARINE CORPS AIR STATION CHERRY POINT, NORTH CAROLINA

PIT 15 SITE REMEDIATION

"AS-BUILT" – CONTROL LOGIC

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945858
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 11 OF 14

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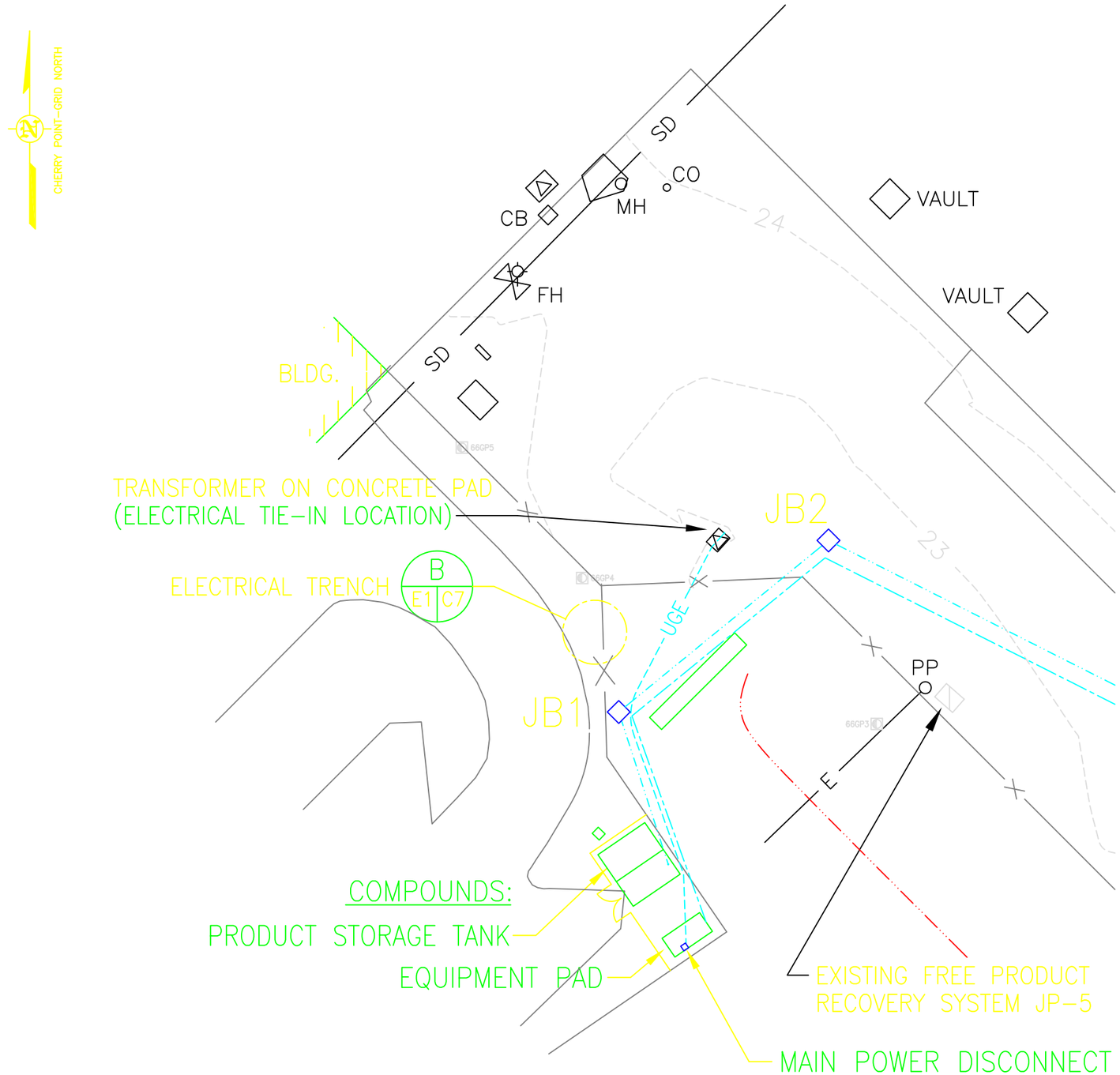

REFERENCE:

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GRAPHIC SCALE
IF THIS DRAWING IS A REDUCTION, USE GRAPHIC SCALE

1" = 20'-0" 0 20 40 60 80

REVISIONS			
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PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

JA JONES

A/E CONTRACT NO.
APPROVED DATE
ACTIVITY - SATISFACTORY TO
APPROVED DATE
FOR EFD FOR COMMANDER SWFAC
SIGN.

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL STATION ATLANTIC DIVISION NORFOLK, VIRGINIA
MARINE CORPS AIR STATION CHERRY POINT, NORTH CAROLINA

PIT 15 SITE REMEDIATION

"AS-BUILT" - ELECTRICAL SITE PLAN

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945858
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 12 OF 14

E-1

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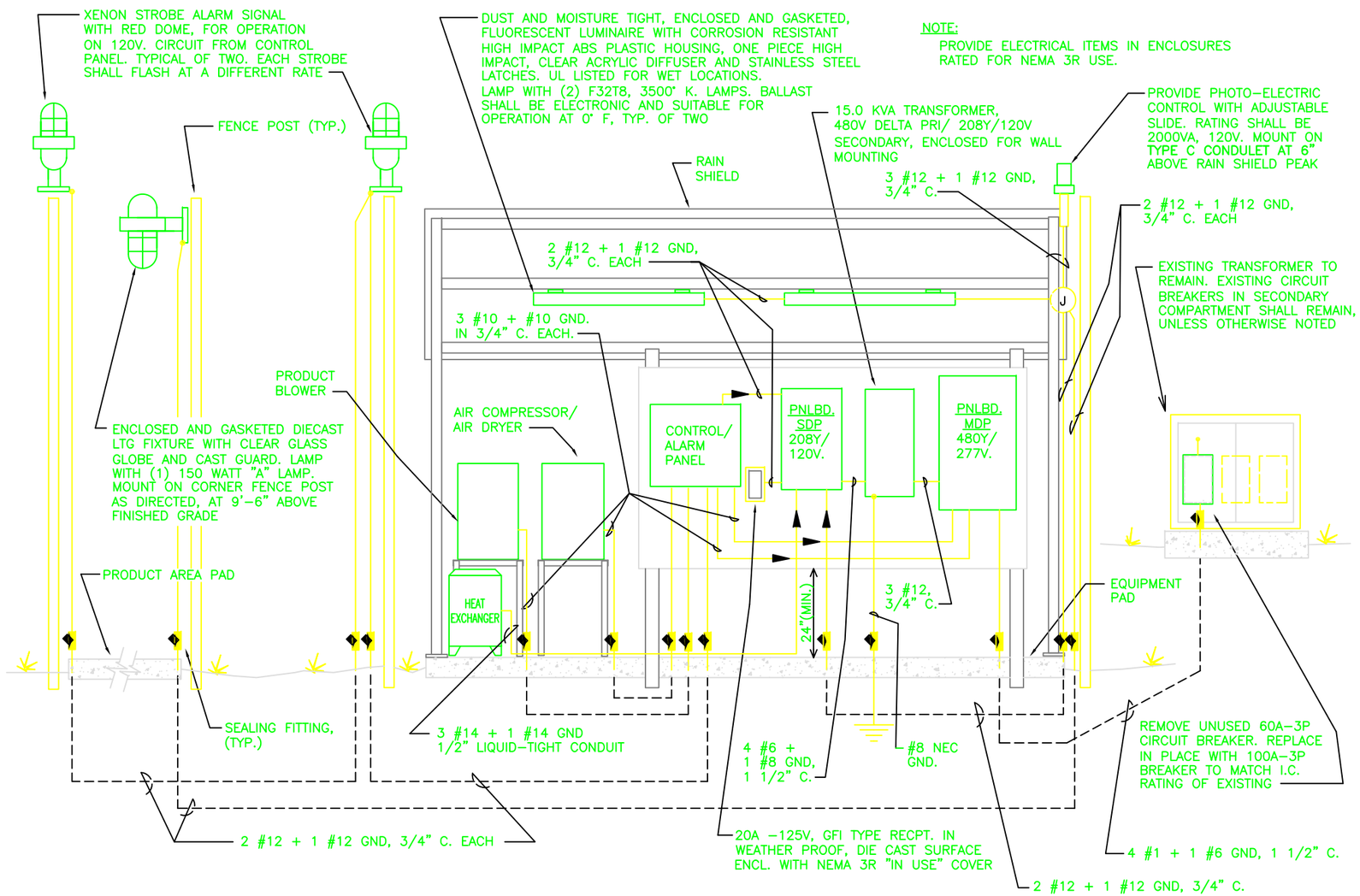

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REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVED

CONTRACTOR: EFD
DESIGN
DRAWN
REVIEW
CHIEF ARCH./ ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

JA JONES

A/E CONTRACT NO.
APPROVED DATE
ACTIVITY - SATISFACTORY TO
APPROVED DATE
FOR EFD FOR COMMANDER INWING
SEAL

DEPARTMENT OF THE NAVY
NAVAL STATION
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA

PIT 15 SITE REMEDIATION

"AS-BUILT" - EQUIPMENT WIRING DIAGRAM

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945858
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 13 OF 14
E-2

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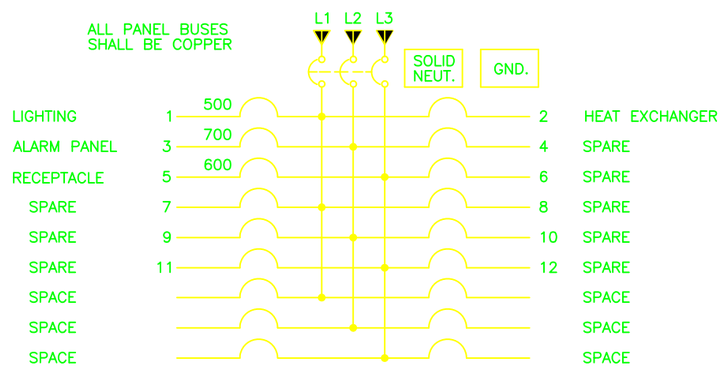
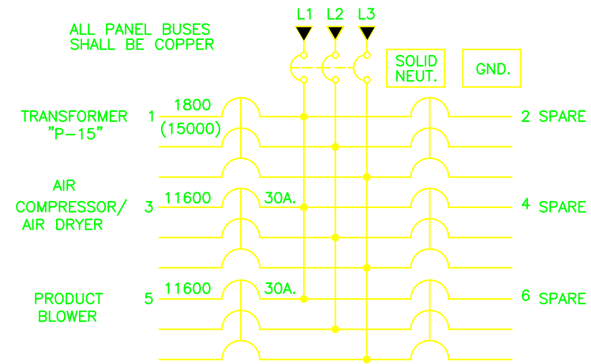


ALL BRANCH CIRCUIT BKR'S 20 AMP EXCEPT AS NOTED

PANELBOARD ''SDP''

MAINS: 50A BREAKER
VOLTAGE: 208Y/120V.– 3 PHASE, 4 WIRE
MTG./LOC.: SURFACE, IN NEMA 3R ENCLOSURE



ALL BRANCH CIRCUIT BKR'S 20 AMP EXCEPT AS NOTED

PANELBOARD ''MDP''

MAINS: 100A BREAKER, SERVICE ENTRANCE RATED
VOLTAGE: 480Y/277V.– 3 PHASE, 4 WIRE
MTG./LOC.: SURFACE, IN NEMA 3R ENCLOSURE

DRAWING NOT TO SCALE

REVISIONS

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CHIEF ARCH/ ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

JA JONES

A/E CONTRACT NO.
APPROVED DATE
ACTIVITY – SATISFACTORY TO
APPROVED DATE
FOR EFD FOR COMMANDER SWFAC
SIGN.

DEPARTMENT OF THE NAVY
NAVAL STATION
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
MARINE CORPS AIR STATION CHERRY POINT, NORTH CAROLINA

PIT 15 SITE REMEDIATION

''AS-BUILT'' – PANELBOARD DISTRIBUTION

CODE ID. NO. ____ SIZE D
SCALE: AS NOTED
EFD NO.
STA. PROJ. NO. 945858
SPEC. NO.
CONSTR. CONTR. NO. N62470-93-D-3033
NAVFAC DRAWING NO.
SHEET 14 OF 14

E-3

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Appendix B
ARARs and TBCs

EPA Legal Recommended List of Chemical- and Location-Specific ARARs for Site 90 (OU 14) Feasibility Study at Marine Corps Air Station Cherry Point, North Carolina

Action	Requirements	Prerequisite	Citation
Chemical-Specific ARARs			
Classification of contaminated groundwater	Groundwaters in the state naturally containing 250 mg/L or less of chloride are *classified as GA* under 15A NCAC 02L .0201(1)	Groundwaters located within the boundaries or under the extraterritorial jurisdiction of the State of North Carolina **— applicable**	15A NCAC 02L .0302(1)
Restoration of contaminated groundwater	Shall not exceed the groundwater quality standards[1] for contaminants specified in Paragraphs (g) or (h) for the site related contaminants of concern. Bromomethane (21.1 µg/L) Chloromethane (2.6 µg/L) cis-1,2-Dichloroethene (70 µg/L) 1,1-Dichloroethane (70 µg/L) 1,2-Dichloroethane (0.38 µg/L) Methylene Chloride (4.6 µg/L) Tetrachloroethene (0.7 µg/L) Trichloroethene (2.8 µg/L) Vinyl Chloride (0.015 µg/L)	Class GA or GSA groundwaters with contaminant(s) concentrations exceeding standards listed in 15A NCAC 02L .0202 **— applicable**	15A NCAC 02L .0202(a) and (b)
	Shall not exceed the Safe Drinking Water Act National Revised Primary Drinking Water Regulations: maximum contaminant levels (MCLs) for organic contaminants specified in 40 CFR 141.61(a).	Groundwaters classified as GA or GSA which are an existing or potential source of drinking water**— relevant and appropriate**	40 CFR 141.61(a) 15A NCAC 18C .1517
Protection of adjacent surface water body	Monitor and undertake management practices for sources of pollution such that water quality standards and best usage of receiving waters and all downstream waters will not be impaired.	Indirect discharges of waste or other source of water pollution into surface waters classified as Class C[2] **— relevant and appropriate**	15A NCAC 02B .0203

[1] Groundwater quality standards established on the basis of a National secondary drinking water standards are not utilized as remediation goals since these are based on taste, odor and other considerations unrelated to human health.
[2] The unnamed stream at OU14, Sandy Branch, and East Prong Slocum Creek are classified as Class C estuarine water by NCDENR. These waters are suitable for fish and wildlife and secondary recreation (i.e., not considered suitable for swimming or potable use).

EPA Legal Recommended List of Chemical- and Location-Specific ARARs for Site 90 (OU 14) Feasibility Study at Marine Corps Air Station Cherry Point, North Carolina

Action	Requirements	Prerequisite	Citation
Protection of adjacent surface water body	The concentrations of toxic substances, either alone or in combination with other wastes, in surface waters shall not render waters injurious to aquatic life or wildlife, recreational activities, public health, or impair the waters for any designated uses.	Nonpoint discharges into surface waters classified as Class C (see footnote 2) — **relevant and appropriate**	15A NCAC 02B .0208
	Toxic substances: shall not exceed the numerical quality standards (maximum permissible levels) to protect human health from carcinogens through consumption of fish (and shellfish). Tetrachloroethene (3.3 µg/L) Trichloroethene (30 µg/L) Vinyl Chloride (2.4 µg/L)	Nonpoint discharges (containing toxic substances which are carcinogens) into surface waters classified as Class C (see footnote 2) **— relevant and appropriate**	15A NCAC 02B .0208(a)(2)B)
Protection of adjacent surface water body	Shall not exceed 25 NTU turbidity level (unless due to natural background conditions). Compliance with this standard can be met when land management activities employ Best Management Practices [as defined by Rule .0202 of this Section].	Nonpoint discharges into surface waters classified as Class C in 15A NCAC 02B .0211 **— relevant and appropriate**	15A NCAC 02B .0211(3)(k)
	Toxic substances: shall not exceed the numerical quality standards (maximum permissible levels) provided in subparagraphs (i) through (xi) to protect aquatic life.	**relevant and appropriate**	15A NCAC 02B .0211(3)(l)
Location-Specific ARARs			
Presence of floodplain designated as such on a map	Shall consider alternatives to avoid, to the extent possible adverse effects and incompatible development in the floodplain.	Federal actions that involve potential impacts to, or take place within, floodplains—**TBC**	Executive Order 11988 Section 2(a)(2)

EPA Legal Recommended List of Action-Specific ARARs/TBC
For Site 90 (OU14) Feasibility Study at Marine Corps Air Station Cherry Point, North Carolina

Action	Requirements	Prerequisite	Citation
General Construction Standards — All Land-disturbing Activities (i.e., excavation, clearing, grading, etc.)			
Managing fugitive dust emissions	Shall not cause or allow fugitive dust emissions to cause or contribute to substantive complaints, or visible emissions in excess of that allowed under paragraph (e) of this Rule.	Activities within facility boundary that will generate fugitive dust emissions **— relevant and appropriate**	15A NCAC 02D .0540(c)
	Implement methods (e.g. wetting dry soils) to control dust emissions that could travel beyond the facility boundary.	**relevant and appropriate**	15A NCAC 02D .0540(g)
Monitoring Well Installation, Operation, and Abandonment			
Construction of groundwater monitoring well(s)	No well shall be located, constructed, operated, or repaired in any manner that may adversely impact the quality of groundwater.	Installation of wells (including temporary) other than for water supply **— applicable**	15A NCAC 02C .0108(a)
	Shall be located, designed, constructed, operated and abandoned with materials and by methods which are compatible with the chemical and physical properties of the contaminants involved, specific site conditions, and specific subsurface conditions.	**applicable**	15A NCAC 02C .0108(c)
	Must comply with general requirements for construction of a well as provided in 15A NCAC 02C .0108(c)(1) through (12)	**applicable**	15A NCAC 02C .0108(c)
	Shall be constructed in such a manner as to preclude the vertical migration of contaminants with and along borehole channel.	**applicable**	15A NCAC 02C .0108(f)
Implementation of groundwater monitoring system	Shall be constructed in a manner that will not result in contamination of adjacent groundwaters of a higher quality.	Installation of monitoring system to evaluate effects of any actions taken to restore groundwater quality, as well as the efficacy of treatment **— applicable**	15A NCAC 02L .0110 (b)

EPA Legal Recommended List of Action-Specific ARARs/TBC
For Site 90 (OU14) Feasibility Study at Marine Corps Air Station Cherry Point, North Carolina

Action	Requirements	Prerequisite	Citation
Maintenance of groundwater monitoring well(s)	Every well shall be maintained by the owner in a condition whereby it will conserve and protect groundwater resources, and whereby it will not be a source or channel of contamination or pollution to the water supply or any aquifer.	Installation of wells (including temporary wells) other than for water supply **— applicable**	15A NCAC 02C .0112(a)
	Broken, punctured, or otherwise defective or unserviceable casing, screens, fixtures, seals, or any part of the well head shall be repaired or replaced, or the well shall be abandoned pursuant to 15A NCAC 02C .0113	**applicable**	15A NCAC 02C .0112(c)
	All materials used in the maintenance, replacement, or repair of any well shall meet the requirements for new installation.	**applicable**	15A NCAC 02C .0112(b)
Abandonment of groundwater monitoring well(s)	Shall be abandoned in accordance with the requirements of 15A NCAC 02C .0113(b)(1) and (2)	Permanent abandonment of wells (including temporary wells) other than for water supply **— applicable**	15A NCAC 02C .0113(b)
Underground Injection Well Installation, Operation, and Abandonment			
Construction of injection well(s) for *in-situ* treatment of groundwater	Construction, use or operation may be allowed provided the injected material does not contain any waste or any substance of a composition and concentration such that, if it were discharged to the land or waters of the state, would create a threat to human health or would otherwise render those waters unsuitable for their intended usage.	Installation of Class 5 underground injection well (Type I – In-situ Groundwater Remediation Well) **— applicable**	15A NCAC 02C .0209(e)(3)
	Shall provide information on the injection well, procedure, and material otherwise required for obtaining a permit in the Remedial Design or Remedial Action Work Plan.	**applicable**	15A NCAC 02C .0211(d)(3)

EPA Legal Recommended List of Action-Specific ARARs/TBC
For Site 90 (OU14) Feasibility Study at Marine Corps Air Station Cherry Point, North Carolina

Action	Requirements	Prerequisite	Citation
Location of injection well(s) for *in-situ* treatment of groundwater	Shall not be located in an area generally subject to flooding. Areas which are generally subject to flooding include those with concave slope, alluvial or colluvial soils, gullies, depressions, and drainage ways.	Installation of Class 5 underground injection well (Type I – In-situ Groundwater Remediation Well) **— applicable**	15A NCAC 02C .0213(a)(1)
	Shall not be located at a point where the injectant would degrade the existing quality of the groundwater in the water-bearing unit into which the injectant is being released.	Installation of Class 5 underground injection well (Type I – In-situ Groundwater Remediation Well) where the concentration of any component of the injectant *exceeds* the groundwater quality standards specified in 15A NCAC 2L .0202 **— applicable**	15A NCAC 02C .0213(a)(2)(A)(i)
	Shall not be located at a point where the injectant would result in a contravention of any of the aforementioned groundwater quality standards in the water-bearing unit into which the injectant is being released.	Installation of Class 5 underground injection well (Type I – In-situ Groundwater Remediation Well) where the concentration of any component of the injectant *is less than* the groundwater quality standards specified in 15A NCAC 2L .0202 **— applicable**	15A NCAC 02C .0213(a)(2)(B)
Construction of injection well(s) for *in-situ* treatment of groundwater	Shall follow the procedures, methods, specified materials, and requirements specified in the subparagraphs (A) through (G) of this Rule for Drilling, Casing, Screens and Testing.	Installation of Class 5 underground injection well (Type I – In-situ Groundwater Remediation Well) **— applicable**	15A NCAC 02C .0213(c)(1) through (4)
	Shall follow the procedures, methods, specified materials, and requirements specified in the paragraphs (1) through (8) of this Rule for Grouting and Sand-and-Gravel Packing.	**applicable**	15A NCAC 02C .0213(d)
Operating an injection well(s) for *in-situ* treatment of groundwater	Pressure at the well head shall be limited to a maximum which will ensure the pressure in the injection zone does not initiate new fractures or propagate existing fractures in the injection zone, initiate fractures in the confining zone, or cause the migration of injected or formation fluids outside the injection zone or area.	**applicable**	15A NCAC 02C .0213(e)

EPA Legal Recommended List of Action-Specific ARARs/TBC
For Site 90 (OU14) Feasibility Study at Marine Corps Air Station Cherry Point, North Carolina

Action	Requirements	Prerequisite	Citation
Abandonment of injection well(s) for *in-situ* treatment of groundwater	Shall be abandoned in accordance with the requirements of subparagraphs (1) and (2) of 15A NCAC 02C .0114.	Installation of Class 5 underground injection well (Type I – In-situ Groundwater Remediation Well *or* Type 5L Closed-Loop Groundwater Remediation Well), including exploratory or test wells **— applicable**	15A NCAC 02C .0215(a)
Control of Diffuse VOC Emissions from Groundwater Treatment			
Emissions of VOCs from groundwater treatment (e.g., sparging system)	Shall not emit any of the toxic air pollutants listed in the table of the Rule in such quantities that may cause or contribute beyond the premises (adjacent property boundary) to any significant ambient air concentration that may adversely affect human health.	Emissions of toxic air pollutants (e.g., VOCs) from facility into the ambient air **— applicable**	15A NCAC 02D .1104
	Shall install and operate reasonable available control technology to limit emissions of VOCs	Air emissions of VOCs from facilities where there is no other applicable emissions control rule **— relevant and appropriate**	15A NCAC 02D .0951(c)
	One of the applicable test methods in Appendix M in 40 CFR part 51 or Appendix A in 40 CFR Part 60 shall be used to determine compliance with VOC emission standards.	VOC emission source not covered by 15A NCAC 02D.2613(b) through (e) **— relevant and appropriate**	15A NCAC 02D .2613(g)
	Control emissions by meeting limitations and work practice standards reflecting application of the maximum achievable control technology. Periodic inspection of equipment and monitoring are required for the life of the remediation.	Air emissions of organic Hazardous Air Pollutants (e.g.,VOCs) from site remediation **— relevant and appropriate**	40 CFR 63 Subpart GGGGG, NESHAPS for Site Remediation

EPA Legal Recommended List of Action-Specific ARARs/TBC
For Site 90 (OU14) Feasibility Study at Marine Corps Air Station Cherry Point, North Carolina

Action	Requirements	Prerequisite	Citation
Waste Characterization and Storage — Primary Wastes (i.e., excavated contaminated soils)			
Characterization of solid waste (e.g., well soil cuttings)	Must determine if solid waste is hazardous waste or if waste is excluded under 40 CFR 261.4(b); and	Generation of solid waste as defined in 40 CFR 261.2 and which is not excluded under 40 CFR 261.4(a) —**applicable**	40 CFR 262.11(a)
	Must determine if waste is listed under 40 CFR Part 261; or	**applicable**	40 CFR 262.11(b)
	Must characterize waste by using prescribed testing methods or applying generator knowledge based on information regarding material or processes used.	**applicable**	40 CFR 262.11(c)
	Must refer to Parts 261, 262, 264, 265, 266, 268, and 273 of Chapter 40 for possible exclusions or restrictions pertaining to management of the specific waste.	Generation of solid waste which is determined to be hazardous —**applicable**	40 CFR 262.11(d)
Storage of solid waste	All solid waste shall be stored in such a manner as to prevent the creation of a nuisance, insanitary conditions, or a potential public health hazard.	Generation of solid waste which is determined *not* to be hazardous —**relevant and appropriate**	15A NCAC 13B .0104(f)
	Containers for the storage of solid waste shall be maintained in such a manner as to prevent the creation of a nuisance or insanitary conditions. Containers that are broken or that otherwise fail to meet this Rule shall be replaced with acceptable containers.	**relevant and appropriate**	15A NCAC 13B .0104(e)
Characterization of hazardous waste	Must obtain a detailed chemical and physical analysis on a representative sample of the waste(s), which at a minimum contains all the information that must be known to treat, store, or dispose of the waste in accordance with pertinent sections of 40 CFR 264 and 268.	Generation of RCRA-hazardous waste for storage, treatment or disposal —**applicable**	40 CFR 264.13(a)(1)

EPA Legal Recommended List of Action-Specific ARARs/TBC
For Site 90 (OU14) Feasibility Study at Marine Corps Air Station Cherry Point, North Carolina

Action	Requirements	Prerequisite	Citation
	Must determine the underlying hazardous constituents [as defined in 40 CFR 268.2(i)] in the waste.	Generation of RCRA characteristic hazardous waste (and is not D001 non-wastewaters treated by CMBST, RORGS, or POLYM of Section 268.42 Table 1) for storage, treatment or disposal — **applicable**	40 CFR 268.9(a)
	Must determine if the waste is restricted from land disposal under 40 CFR 268 *et seq.* by testing in accordance with prescribed methods or use of generator knowledge of waste.	**applicable**	40 CFR 268.7
	Must determine each EPA Hazardous Waste Number (Waste Code) to determine the applicable treatment standards under 40 CFR 268.40 *et. seq*.	**applicable**	40 CFR 268.9(a)
Temporary storage of hazardous waste in containers	A generator may accumulate hazardous waste at the facility provided that: • waste is placed in containers that comply with 40 CFR 265.171-173; and	Accumulation of RCRA hazardous waste on site as defined in 40 CFR 260.10 — **applicable**	40 CFR 262.34(a) 40 CFR 262.34(a)(1)(i)
	• the date upon which accumulation begins is clearly marked and visible for inspection on each container	**applicable**	40 CFR 262.34(a)(2)
	• container is marked with the words “hazardous waste”; or	**applicable**	40 CFR 264.34(a)(3)
	• container may be marked with other words that identify the contents.	Accumulation of 55 gal. or less of RCRA hazardous waste at or near any point of generation — **applicable**	40 CFR 262.34(c)(1)
Use and management of hazardous waste in containers	If container is not in good condition (e.g. severe rusting, structural defects) or if it begins to leak, must transfer waste into container in good condition	Storage of RCRA hazardous waste in containers — **applicable**	40 CFR 265.171
	Use container made or lined with materials compatible with waste to be stored so that the ability of the container is not impaired	**applicable**	40 CFR 265.172

EPA Legal Recommended List of Action-Specific ARARs/TBC
For Site 90 (OU14) Feasibility Study at Marine Corps Air Station Cherry Point, North Carolina

Action	Requirements	Prerequisite	Citation
	Keep containers closed during storage, except to add/remove waste	**applicable**	40 CFR 265.173(a)
	Open, handle and store containers in a manner that will not cause containers to rupture or leak	**applicable**	40 CFR 265.173(b)
Waste treatment and disposal—primary wastes (excavated contaminated soils)			
Disposal of solid waste	Shall ensure that waste is disposed of at a site or facility which is permitted to receive the waste.	Generation of solid waste intended for off-site disposal — **relevant and appropriate**	15A NCAC 13B .0106(b)
Disposal of RCRA-hazardous waste in a land-based unit	May be land disposed if it meets the requirements in the table "Treatment Standards for Hazardous Waste" at 40 CFR 268.40 before land disposal.	Land disposal, as defined in 40 CFR 268.2, of restricted RCRA waste —**applicable**	40 CFR 268.40(a)
	Must be treated according to the alternative treatment standards of 40 CFR 268.49(c) <u>or</u> Must be treated according to the UTSs [specified in 40 CFR 268.48 Table UTS] applicable to the listed and/or characteristic waste contaminating the soil prior to land disposal.	Land disposal, as defined in 40 CFR 268.2, of restricted hazardous soils —**applicable**	40 CFR 268.49(b)
Transportation of Wastes			
Transportation of hazardous waste on-site	The generator manifesting requirements of 40 CFR 262.20–262.32(b) do not apply. Generator or transporter must comply with the requirements set forth in 40 CFR 263.30 and 263.31 in the event of a discharge of hazardous waste on a private or public right-of-way.	Transportation of hazardous wastes on a public or private right-of-way within or along the border of contiguous property under the control of the same person, even if such contiguous property is divided by a public or private right-of-way — **applicable**	40 CFR 262.20(f)
Transportation of hazardous waste off-site	Must comply with the generator requirements of 40 CFR 262.20–23 for manifesting, Sect. 262.30 for packaging, Sect. 262.31 for labeling, Sect. 262.32 for marking, Sect. 262.33 for placarding, Sect. 262.40, 262.41(a) for record keeping requirements, and Sect. 262.12 to obtain EPA ID number.	Off-site transportation of RCRA-hazardous waste — **applicable**	40 CFR 262.10(h)

EPA Legal Recommended List of Action-Specific ARARs/TBC
For Site 90 (OU14) Feasibility Study at Marine Corps Air Station Cherry Point, North Carolina

Action	Requirements	Prerequisite	Citation
	Must comply with the requirements of 40 CFR 263.11–263.31.	Transportation of hazardous waste within the United States requiring a manifest — **applicable**	40 CFR 263.10(a)
	A transporter who meets all applicable requirements of 49 CFR 171–179 and the requirements of 40 CFR 263.11 and 263.31 will be deemed in compliance with 40 CFR 263.	**applicable**	
Transportation of hazardous materials	Shall be subject to and must comply with all applicable provisions of the HMTA and DOT HMR at 49 CFR 171-180.	Any person who, under contract with a department or agency of the federal government, transports "in commerce," or causes to be transported or shipped, a hazardous material **— applicable**	49 CFR 171.1(c)
Institutional Controls for Contamination Left in Place			
Notice of Contaminated Site	Prepare and certify by professional land surveyor a survey plat which identifies contaminated areas which shall be entitled "NOTICE OF CONTAMINATED SITE". Notice shall include a legal description of the site that would be sufficient as a description in an instrument of conveyance and meet the requirements of NCGS 47-30 for maps and plans.	Contaminated site subject to current or future use restrictions included in a remedial action plan as provided in G.S. 143B-279.9(a) — **TBC**	NCGS 143B-279.10(a)
	The Survey plat shall identify: • the location and dimensions of any disposal areas and areas of potential environmental concern with respect to permanently surveyed benchmarks; • the type location, and quantity of contamination known to exist on the site; and •any use restriction on the current or future use of the site.	**TBC**	NCGS 143B-279.10(a)(1)-(3)

EPA Legal Recommended List of Action-Specific ARARs/TBC
For Site 90 (OU14) Feasibility Study at Marine Corps Air Station Cherry Point, North Carolina

Action	Requirements	Prerequisite	Citation
	Notice (survey plat) shall be filed in the register of deeds office in the county which the site is located in the grantor index under the name of the owner.	**TBC**	NCGS 143B-279.10(b) and (c)
	The deed or other instrument of transfer shall contain in the description section, in no smaller type than used in the body of the deed or instrument, a statement that the property is a contaminated site and reference by book and page to the recordation of the Notice.	Contaminated site subject to current or future use restrictions as provided in G.S. 143B-279.9(a) that is to sold, leased, conveyed or transferred — **TBC**	NCGS 143B-279.10(e)

Appendix C
Cost Estimates

Appendix C - Cost Estimates
Summary of Cost Analysis
OU14, Site 90 Feasibility Study
MCAS Cherry Point, North Carolina

Alternative		Alternative 1 No Action	Alternative 2 LUCs			Alternative 3 MNA			Alternative 4 Biosparge, MNA, & LUCs			Alternative 5 ERD, MNA, & LUCs		
Alternative Evaluation Timeframe[1]		0 years	100 years			100 years			40 years			60 years		
			-30%	Estimate	+50%	-30%	Estimate	+50%	-30%	Estimate	+50%	-30%	Estimate	+50%
Total Implementation Costs		$0	$8,000	$11,000	$17,000	$289,000	$413,000	$620,000	$1,254,000	$1,792,000	$2,687,000	$1,558,000	$2,225,000	$3,338,000
Present Value of Future Costs	Discount Rate of 2.7% (OMB, 2008)	$0	$486,000	$695,000	$1,042,000	$1,164,000	$1,663,000	$2,494,000	$2,299,000	$3,284,000	$4,926,000	$2,788,000	$3,982,000	$5,973,000
Grand Total Present Value	**Discount Rate of 2.7% (OMB, 2008)**	**$0**	***$494,000***	**$706,000**	***$1,059,000***	***$1,453,000***	**$2,076,000**	***$3,114,000***	***$3,553,000***	**$5,076,000**	***$7,613,000***	***$4,346,000***	**$6,207,000**	***$9,311,000***

Notes and References:

● The 100-year timeframe evaluated for Alternative 2-LUCs is for reference. The cost of LUCs are built into each of Alternatives 3, 4, and 5 for each alternative's respective timeframe (100 years, 40 years, and 60 years,

● The "Real" Discount Rate used to calculate the Present Value cost is 2.7% for a timeframe greater than 30 years per the Office of Management and Budget (OMB), Circular A-94, Appendix C, Revised December 2008, "Discount Rates for Cost Effectiveness, Lease Purchase, and Related Analysis" for Calendar Year 2009, http://www.whitehouse.gov/omb/circulars_a094_a94_appx-c/.

The Real Discount Rates are a forecast of real interest rates from which the inflation premium has been removed and based on the economic assumptions from the December 2010 Budget Baseline. These real rates are to be used for discounting constant-dollar flows, as is often required in cost-effectiveness analysis.

● USEPA. 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* . OSWER Directive 9355.3-01. EPA/540/G-89/004. October.

● USEPA. 2000. *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study* . With the U.S. Army Corps of Engineers. OSWER 9355.0-75. EPA 540-R-00-002. July.

● The information in this cost estimate is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during Baseline Sampling and the Remedial Design phase. This is an order-of-magnitude engineering cost estimate that is expected to be within –30 to +50 percent of the actual project cost (per USEPA, 1988 and 2000).

[1]The Alternative Evaluation Timeframes listed for Alternatives 3, 4, and 5 are conservative estimates. The estimates do not take into account the presence of (1) POL contamination and it's potential to facilitate and expedite biodegradation by providing an energy source to naturally-occurring bacteria; and (2) UST Remediation Systems, which, depending on aquifer conditions, can facilitate or impede the removal and degradation of various CVOCs.

Table C-1
Cost Estimate for Alternative 1 - No Action
OU14, Site 90 Feasibility Study
MCAS Cherry Point, North Carolina

No Action
Cost = $0

Table C-2 - Cost Estimate for Alternative 2 - LUCs
OU14, Site 90 Feasibility Study, MCAS Cherry Point, North Carolina

Assumptions:
LUC RD prepared by contractor. 5YR performed with other reviewed-post-remedy sites at MCAS Cherry Point. Quarterly inspections and reports performed by contractor.
Alternative 2 - LUCs cost estimate for a 30-Year timeframe provided for reference. Alternative 2 will not be implemented because LUCs alone would not meet the Remedial Action Objectives. Alternatives 3, 4, and 5 each include LUCs.
Present Value (PV) calculated using Real Discount Rate of 2.7% per OMB (2008), as well as alternate PV (for reference/comparison) calculated using Real Discount Rate of 7% per USEPA (2000) (see below).

Item/Activity	Qty	Unit	Unit Cost	Cost	Notes & Comments
IMPLEMENTATION COST					
LUCs					
LUC Remedial Design and implementation into MCAS Cherry Point's plan & GIS, and into Navy's *LUC Tracker*.	1	each	$8,000	$8,000	Includes Draft and Final LUC Plans. Assume contractor prepares LUC RD.
Subtotal				*$8,000*	
Contingency	*15%*			*$1,200*	
Project Management	*10%*			*$800*	
G&A	*7%*			*$560*	
Overhead & Profit	*8%*			*$640*	
Total Implementation Cost				**$11,200**	
FUTURE COSTS (100 years)					
LUCs (Years 1-100)					
IR Quarterly Inspections and reporting (4 per year)	100	year	$16,000	$1,600,000	4 inspections per year at $4,000 per inspection -- for 100 yrs. Assume contractor performs site inspections and reporting.
Subtotal			*$16,000*	*$1,600,000*	
Project Management	*10%*		*$1,600*	*$160,000*	
Subtotal			*$17,600*	*$1,760,000*	
LUCs Future Annual Cost			$17,600		
LUCs Total Future Cost				$1,760,000	
Present Value (2.7%) of Future Cost of LUCs	100	*year*	*2.7%*	*$606,447*	*Y2009 PV calculated for 100-yrs-future-cost using 2.7% Real Discount Rate per Office of Management and Budget (2008) guidance.*
5-Year Reviews (Years 5, 10, 15, 20, 25... and 100)					
5-Year Review	20	each	$10,000	$270,000	5YR conducted once every 5 years. To be conducted in conjunction with other post-ROD sites at MCAS Cherry Point. Years, 5, 10… and 100. Includes pre-draft, draft, draft-final, final, fact sheet, and public notices.
Subtotal			*$10,000*	*$270,000*	
Contingency	*10%*		*$1,000*	*$27,000*	
Project Management	*10%*		*$1,000*	*$27,000*	
General Conditions and Administration	*7%*		*$700*	*$18,900*	
Overhead & Profit	*8%*		*$800*	*$21,600*	
Subtotal			*$13,500*	*$364,500*	
5YR Future Annual Cost at Years 5, 10… and 100)			$13,500		
5YR Total Future Cost				$364,500	
Present Value (2.7%) of Future Cost of 5YRs	100	*year*	*2.7%*	*$88,144*	*Y2009 PV calculated for 100-yrs-future-cost using 2.7% Real Discount Rate per Office of Management and Budget (2008) guidance.*
Total Present Value (2.7%) of All Future Costs			**2.7%**	**$694,591**	Y2009 PV calculated for 100-yrs-future-cost using 2.7% Real Discount Rate per Office of Management and Budget (2008) guidance.
TOTAL PV Cost of Alternative 2 - LUCs			*-30%*	*+50%*	
Using 2.7% Discount Rate for PV of Future Costs	**$705,791**		*$494,054*	*$1,058,687*	

Other Notes and References:

● The 100-year timeframe evaluated for this Alternative 2-LUCs is for reference. The cost of LUCs are built into each of Alternatives 3, 4, and 5 for each alternative's respective timeframe (100 years, 40 years, and 60 years, respectively).

● The "Real" Discount Rate used to calculate the Present Value cost is 2.7% for a 100-year timeframe per the Office of Management and Budget (OMB), Circular A-94, Appendix C, Revised December 2008, "Discount Rates for Cost Effectiveness, Lease Purchase, and Related Analysis" for Calendar Year 2009, http://www.whitehouse.gov/omb/circulars_a094_a94_appx-c/.

The Real Discount Rates are a forecast of real interest rates from which the inflation premium has been removed and based on the economic assumptions from the December 2010 Budget Baseline. These real rates are to be used for discounting constant-dollar flows, as is often required in cost-effectiveness analysis.

● This Alternative 2 - LUCs (and the 5-Year Reviews) will be implemented regardless of the selected alternative (except Alternative 1 - No Action).

● USEPA. 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* . OSWER Directive 9355.3-01. EPA/540/G-89/004. October.

● USEPA. 2000. *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study* . With the U.S. Army Corps of Engineers. OSWER 9355.0-75. EPA 540-R-00-002. July.

● The information in this cost estimate is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during Baseline Sampling and the Remedial Design phase. This is an order-of-magnitude engineering cost estimate that is expected to be within –30 to +50 percent of the actual project cost (per USEPA, 1988 and 2000).

Table C-3 - Cost Estimate for Alternative 3 - MNA and LUCs
OU14, Site 90 Feasibility Study, MCAS Cherry Point, North Carolina

Assumptions:
LUC RD prepared by contractor. 5YR performed with other MCAS Cherry Point sites. Quarterly inspections performed by contractor. Well maintenance required every 5yrs.
Baseline sampling of 60 wells for COCs and geochemical and biodegradation-related analyses.
Following review of baseline data, install 25 new monitoring wells: 15 shallow at 15-35 ft bgs and 10 deep at 35-50 ft bgs. Sample these for additional baseline data (COCs and geochem/biodeg analyses).
MNA performance monitoring at 9-month intervals through Year 3 to determine seasonal variations. Then Year 5, 10, 15, through Year 100. 50 wells.

Item/Activity	Qty	Unit	Unit Cost	Cost	Notes & Comments
IMPLEMENTATION COST					
LUCs					
LUC Remedial Design and implementation into MCAS Cherry Point's plan & GIS, and into Navy's *LUC Tracker*.	1	each	$8,000	$8,000	Includes Draft and Final LUC Plans. Assume contractor prepares LUC RD.
UFP-SAP					
Work Plan for additional sampling, well installation, and groundwater performance monitoring (in Navy's UFP-SAP format).	1	each	$30,000	$30,000	Pre-Draft, Draft, Draft Final, & Final. Includes Scoping sessions. Recent similar project.
Baseline Sampling (60 existing Wells)					
Labor, ODCs, travel	1	event	$21,000	$21,000	Assume sample 60 wells. TBD by Team.
Lab & Data Validation	1	each	$46,524	$46,524	See lab & DV backup sheets
Equipment	1	event	$4,400	$4,400	
Report	1	each	$8,000	$8,000	
New Well Installation (25 new wells)					
Labor, ODCs, travel	1	event	$19,000	$19,000	15 shallow (15-35 ft bgs) and 10 deep (35-50 ft bgs) new monitoring wells. TBD by Team.
Utility Location	1	LS	$2,000	$2,000	
Drilling Subcontractor / well installation	1,025	LF	$100	$102,500	Includes mob, materials, labor
Survey	1	each	$2,000	$2,000	
Sample New Wells (25 wells)					
Labor, ODCs, travel	1	each	$11,000	$11,000	
Lab & Data Validation	1	each	$20,152	$20,152	
Equipment	1	event	$2,400	$2,400	
Report	1	each	$8,000	$8,000	
Subtotal				*$284,976*	
Contingency	*20%*			*$56,995*	
Project Management	*10%*			*$28,498*	
G&A	*7%*			*$19,948*	
Overhead & Profit	*8%*			*$22,798*	
			Total Implementation Cost	**$413,215**	
FUTURE COSTS (100 years)					
LUCs (Years 1-100)					
IR Quarterly Inspections and reporting (4 per year)	100	year	$16,000	$1,600,000	4 inspections per year at $4,000 per inspection -- for 100 yrs. Assume contractor performs site inspections and reporting.
Subtotal			*$16,000*	*$1,600,000*	
Project Management	*10%*		*$1,600*	*$160,000*	
Subtotal			*$17,600*	*$1,760,000*	
LUCs Future Annual Cost			$17,600		
LUCs Total Future Cost				$1,760,000	
Present Value (2.7%) of Future Cost of LUCs	*100*	*year*	*2.7%*	*$606,447*	*Y2009 PV calculated for 100-yrs-future-cost using 2.7% Real Discount Rate per Office of Management and Budget (2008) guidance.*
5-Year Reviews (Years 5, 10, 15… and 100)					
5-Year Review	20	each	$10,000	$270,000	5YR conducted once every 5 years. To be conducted in conjunction with other post-ROD sites at MCAS Cherry Point. Years, 5, 10… and 100. Includes pre-draft, draft, draft final, final, fact sheet, and public notices.
Subtotal			*$10,000*	*$270,000*	
Contingency	*10%*		*$1,000*	*$27,000*	
Project Management	*10%*		*$1,000*	*$27,000*	
General Conditions and Administration	*7%*		*$700*	*$18,900*	
Overhead & Profit	*8%*		*$800*	*$21,600*	
Subtotal			*$13,500*	*$364,500*	
5YR Total Annual Cost at Years 5, 10… and 100)			$13,500		
5YR Total Future Cost				$364,500	
Present Value (2.7%) of Future Cost of 5YRs	*100*	*year*	*2.7%*	*$88,144*	
Well Maintenance (Years 5, 10, 15… and 95)					
Repair flushmounts & vaults, potential well replacements, etc.	20	event	$15,000	$300,000	Assume well repairs needed approximately every 5 years.
Subtotal			*$15,000*	*$300,000*	
Contingency	*25%*		*$3,750*	*$75,000*	
Project Management	*10%*		*$1,500*	*$30,000*	
General Conditions and Administration	*7%*		*$1,050*	*$21,000*	
Overhead & Profit	*8%*		*$1,200*	*$24,000*	
Subtotal			*$22,500*	*$450,000*	
Well Maintenance Future Annual Cost at Years 5, 10… and 95)			$22,500		
5YR Total Future Cost				$450,000	
Present Value (2.7%) of Future Cost of Well Maintenance	*95*	*year*	*2.7%*	*$145,340*	

Table C-3 - Cost Estimate for Alternative 3 - MNA and LUCs
OU14, Site 90 Feasibility Study, MCAS Cherry Point, North Carolina

Item/Activity	Qty	Unit	Unit Cost	Cost	Notes & Comments
Well Abandonment (Year 100)					
Abandon wells when RAOs are achieved. Driller sub.	90	well	$300	$27,000	Assume well abandonment will occur at Year 100.
Labor	4	week	$7,500	$30,000	assume abandon all IR Program wells
Travel & per diem	4	week	$2,000	$8,000	
Subtotal				*$65,000*	
Contingency	*25%*			*$16,250*	
Project Management	*10%*			*$6,500*	
General Conditions and Administration	*7%*			*$4,550*	
Overhead & Profit	*8%*			*$5,200*	
Subtotal				*$97,500*	
Present Value (2.7%) of Future Cost of Well Abandonment	*100*	*year*	*2.7%*	*$6,791*	
Performance Groundwater Monitoring (50 wells)					
Months 9, 18, 27, and 36					Year 1 includes 9-month event; Year 2 includes 18-month event; and Year 3 includes 27- and 36-month event.
Labor, ODCs, travel	4	event	$15,000	$60,000	Assume 50 wells in performance monitoring program. TBD by Team.
Lab & Data Validation	4	each	$39,185	$156,741	See lab & DV backup sheets
Equipment	4	event	$3,600	$14,400	
Report	4	each	$8,000	$32,000	
Subtotal			*$65,785.32*	*$263,141.28*	
Contingency	*20%*		*$13,157*	*$52,628*	
Project Management	*10%*		*$6,579*	*$26,314*	
G&A	*7%*		*$4,605*	*$18,420*	
Overhead & Profit	*8%*		*$5,263*	*$21,051*	
Subtotal			*$95,389*	*$381,555*	
Present Value (2.7%) of Future Cost of Groundwater Sampling Years 1-3			*2.7%*	*$359,443*	
Years 5, 10, and 15					
Labor, ODCs, travel	3	event	$15,000	$45,000	Assume 50 wells in performance monitoring program. TBD by Team.
Lab & Data Validation	3	each	$39,185	$117,556	See lab & DV backup sheets
Equipment	3	event	$3,600	$10,800	
Report	3	each	$8,000	$24,000	
Subtotal			*$65,785.32*	*$197,355.96*	
Contingency	*20%*		*$13,157*	*$39,471*	
Project Management	*10%*		*$6,579*	*$19,736*	
G&A	*7%*		*$4,605*	*$13,815*	
Overhead & Profit	*8%*		*$5,263*	*$15,788*	
Subtotal			*$95,389*	*$286,166*	
Present Value (2.7%) of Future Cost of Groundwater Sampling Years 1-3			*2.7%*	*$220,536*	
Years 20, 25, 30… and 100					
Labor, ODCs, travel	16	event	$15,000	$240,000	Assume 50 wells in performance monitoring program. TBD by Team.
Lab & Data Validation	16	each	$12,027	$192,432	See lab & DV backup sheets
Equipment	16	event	$3,600	$57,600	
Report	16	each	$8,000	$128,000	
Subtotal			*$38,627.02*	*$618,032.32*	
Contingency	*20%*		*$7,725*	*$123,606*	
Project Management	*10%*		*$3,863*	*$61,803*	
G&A	*7%*		*$2,704*	*$43,262*	
Overhead & Profit	*8%*		*$3,090*	*$49,443*	
Subtotal			*$56,009*	*$896,147*	
Present Value (2.7%) of Future Cost of Groundwater Sampling Years 1-3			*2.7%*	*$236,204*	
Total Present Value (2.7%) of All Future Costs			**2.7%**	**$1,662,906**	Y2009 PV calculated for 100-yrs-future-cost using 2.7% Real Discount Rate per Office of Management and Budget (2008) guidance.
TOTAL PV Cost of Alternative 3 - MNA and LUCs			*-30%*	*+50%*	
Using 2.7% Discount Rate for PV of Future Costs	**$2,076,121**		*$1,453,284*	*$3,114,181*	

Other Notes and References:

● The "Real" Discount Rate used to calculate the Present Value cost is 2.7% for a 100-year timeframe per the Office of Management and Budget (OMB), Circular A-94, Appendix C, Revised December 2008, "Discount Rates for Cost Effectiveness, Lease Purchase, and Related Analysis" for Calendar Year 2009, http://www.whitehouse.gov/omb/circulars_a094_a94_appx-c/.

The Real Discount Rates are a forecast of real interest rates from which the inflation premium has been removed and based on the economic assumptions from the December 2010 Budget Baseline. These real rates are to be used for discounting constant-dollar flows, as is often required in cost-effectiveness analysis.

● USEPA. 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* . OSWER Directive 9355.3-01. EPA/540/G-89/004. October.

● USEPA. 2000. *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study* . With the U.S. Army Corps of Engineers. OSWER 9355.0-75. EPA 540-R-00-002. July.

● The information in this cost estimate is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during Baseline Sampling and the Remedial Design phase. This is an order-of-magnitude engineering cost estimate that is expected to be within –30 to +50 percent of the actual project cost (per USEPA, 1988 and 2000).

Alternative 3 - MNA and LUCs
Lab Backup
OU14 FS, MCAS Cherry Point

Analysis/Test	Sample Matrix	Field Samples	Field Duplicates	Equipment Rinsate Blanks	Field Blanks	Trip Blanks	Matrix Spike	Matrix Spike Duplicate	Total Number of Solid Samples	Total Billable Solid Samples	Solid Unit Price	Solid Subtotal Cost	Total Number of Liquid Samples	Total Billable Liquid Samples	Liquid Unit Price	Liquid Subtotal Cost	Total Analytical Cost
Implementation																	
Baseline Sampling - Assume 60 existing Surficial Aquifer monitoring wells for COCs and other technology-performance monitoring analyses																	
Groundwater wells																	
TCL VOCs by CLP OLM04.3	GW	60	6	12	3	12	5	5					103	103	$111.71	$11,506.13	$11,506.13
Methane, Ethane, Ethene by RSK-175	GW	60	0	0	0	0	3	3					66	66	$105.18	$6,941.88	$6,941.88
Nitrate, Nitrite, Sulfate by USEPA 300.0	GW	60	0	0	0	0	3	3					66	66	$50.87	$3,357.42	$3,357.42
Sulfide by USEPA 376.1	GW	60	0	0	0	0	3	3					66	66	$35.12	$2,317.92	$2,317.92
Alkalinity by USEPA 310.1	GW	60	0	0	0	0	3	3					66	66	$13.73	$906.18	$906.18
Volatile Fatty Acids (VFAs) (Acetic, Butyric, Pyruvic, Propionic, and Lactic Acid) by AM23G	GW	60	0	0	0	0	3	3					66	66	$134.90	$8,903.40	$8,903.40
Total Organic Carbon (TOC) by SW-846 9060 Quadruplicate analysis	GW	60	0	0	0	0	3	3					66	66	$33.21	$2,191.86	$2,191.86
Dissolved Iron and Manganese by SW-846 6010B	GW	60	6	0	0	0	4	4					74	74	$35.73	$2,644.02	$2,644.02
IDW - Purged groundwater and decon water																	
Full TCLP (1311/ 8260B, 8270C, 8151A, 6010B, 7470A, 8081A, 8082)	Aqueous	1											1	1	$657.00	$657.00	$657.00
Corrosivity as pH by SW-846 9045C	Aqueous	1											1	1	$8.82	$8.82	$8.82
Ignitability by Pensky Martens	Aqueous	1											1	1	$27.30	$27.30	$27.30
																Baseline Subtotal	**$39,461.93**
Additional Baseline -- Assume 25 new wells: 15 new shallow and 10 new deep wells																	
Groundwater wells																	
TCL VOCs	GW	25	3	5	1	5	2	2					43	43	$95.00	$4,085.00	$4,085.00
Methane, Ethane, Ethene	GW	25	0	0	0	0	2	2					29	29	$101.09	$2,931.61	$2,931.61
Nitrate, Nitrite, Sulfate	GW	25	0	0	0	0	2	2					29	29	$48.82	$1,415.78	$1,415.78
Sulfide	GW	25	0	0	0	0	2	2					29	29	$21.91	$635.39	$635.39
Alkalinity	GW	25	0	0	0	0	2	2					29	29	$13.18	$382.22	$382.22
VFAs	GW	25	0	0	0	0	2	2					29	29	$128.57	$3,728.53	$3,728.53
TOC	GW	25	0	0	0	0	2	2					29	29	$33.21	$963.09	$963.09
Dissolved Iron and Manganese	GW	25	3	0	0	0	2	2					32	32	$28.08	$898.56	$898.56
IDW - (1) Soil cuttings from new well installations;																	
Full TCLP		2							1	1	$639.00	$639.00	2	2	$657.00	$1,314.00	$1,953.00
Corrosivity	Aqueous	2							1	1	$11.28	$11.28	2	2	$8.45	$16.90	$28.18
Ignitability	& Solid	2							1	1	$26.87	$26.87	2	2	$26.30	$52.60	$79.47
																Additional Baseline Subtotal	**$17,100.83**
																TOTAL IMPLEMENTATION LAB COST	**$56,562.76**
MNA Performance Monitoring / LTM																	
Assume sampling network consists of 50 monitoring wells																	
Months 9, 18, 27, and 36																	
Groundwater wells																	
TCL VOCs	GW	50	5	10	2	10	4	4					85	85	$111.71	$9,495.35	$9,495.35
Methane, Ethane, Ethene	GW	50	0	0	0	0	3	3					56	56	$105.18	$5,890.08	$5,890.08
Nitrate, Nitrite, Sulfate	GW	50	0	0	0	0	3	3					56	56	$50.87	$2,848.72	$2,848.72
Sulfide	GW	50	0	0	0	0	3	3					56	56	$35.12	$1,966.72	$1,966.72
Alkalinity	GW	50	0	0	0	0	3	3					56	56	$13.73	$768.88	$768.88
VFAs	GW	50	0	0	0	0	3	3					56	56	$134.90	$7,554.40	$7,554.40
TOC	GW	50	0	0	0	0	3	3					56	56	$33.21	$1,859.76	$1,859.76
Dissolved Iron and Manganese	GW	50	5	0	0	0	3	3					61	61	$35.73	$2,179.53	$2,179.53
IDW - Purged groundwater and decon water																	
Full TCLP (1311/ 8260B, 8270C, 8151A, 6010B, 7470A, 8081A, 8082)	Aqueous	1											1	1	$657.00	$657.00	$657.00
Corrosivity as pH by SW-846 9045C	Aqueous	1											1	1	$8.82	$8.82	$8.82
Ignitability by Pensky Martens	Aqueous	1											1	1	$27.30	$27.30	$27.30
																Subtotal	**$33,256.56**
																Total for 9,18,27&36 months	**$133,026.24**
Years 5, 10, and 15																	
Groundwater wells																	
TCL VOCs	GW	50	5	10	2	10	4	4					85	85	$111.71	$9,495.35	$9,495.35
Methane, Ethane, Ethene	GW	50	0	0	0	0	3	3					56	56	$105.18	$5,890.08	$5,890.08
Nitrate, Nitrite, Sulfate	GW	50	0	0	0	0	3	3					56	56	$50.87	$2,848.72	$2,848.72
Sulfide	GW	50	0	0	0	0	3	3					56	56	$35.12	$1,966.72	$1,966.72
Alkalinity	GW	50	0	0	0	0	3	3					56	56	$13.73	$768.88	$768.88
VFAs	GW	50	0	0	0	0	3	3					56	56	$134.90	$7,554.40	$7,554.40
TOC	GW	50	0	0	0	0	3	3					56	56	$33.21	$1,859.76	$1,859.76
Dissolved Iron and Manganese	GW	50	5	0	0	0	3	3					61	61	$35.73	$2,179.53	$2,179.53

Alternative 3 - MNA and LUCs
Lab Backup
OU14 FS, MCAS Cherry Point

Analysis/Test	Sample Matrix	Field Samples	Field Duplicates	Equipment Rinsate Blanks	Field Blanks	Trip Blanks	Matrix Spike	Matrix Spike Duplicate	Total Number of Solid Samples	Total Billable Solid Samples	Solid Unit Price	Solid Subtotal Cost	Total Number of Liquid Samples	Total Billable Liquid Samples	Liquid Unit Price	Liquid Subtotal Cost	Total Analytical Cost
IDW - Purged groundwater and decon water																	
Full TCLP (1311/ 8260B, 8270C, 8151A, 6010B, 7470A, 8081A, 8082)	Aqueous	1											1	1	$657.00	$657.00	$657.00
Corrosivity as pH by SW-846 9045C	Aqueous	1											1	1	$8.82	$8.82	$8.82
Ignitability by Pensky Martens	Aqueous	1											1	1	$27.30	$27.30	$27.30
																Subtotal	**$33,256.56**
																Total for 5+10+15	**$99,769.68**
Years 20, 25, 30… and 100 (only VOC analysis)																	
Groundwater wells																	
TCL VOCs	GW	50	5	10	2	10	4	4					85	85	$111.71	$9,495.35	$9,495.35
IDW - Purged groundwater and decon water																	
Full TCLP (1311/ 8260B, 8270C, 8151A, 6010B, 7470A, 8081A, 8082)	Aqueous	1											1	1	$657.00	$657.00	$657.00
Corrosivity as pH by SW-846 9045C	Aqueous	1											1	1	$8.82	$8.82	$8.82
Ignitability by Pensky Martens	Aqueous	1											1	1	$27.30	$27.30	$27.30
																Subtotal	**$10,188.47**
																Total for 20+25+30+35…+95+100	**$163,015.52**
																TOTAL FUTURE LAB COST	**$395,811.44**

Full QA/QC for OU14 COCs only. Also, duplicates for metals. MS/MSDs are billable Standard turnaround time

Analysis/Test	Sample Matrix	Field Samples	Field Duplicates	Equipment Rinsate Blanks	Field Blanks	Trip Blanks	Matrix Spike	Matrix Spike Duplicate	Total Number of Solid Samples	Total Billable Solid Samples	Solid Unit Price	Solid Subtotal Cost	Total Number of Liquid Samples	Total Billable Liquid Samples	Liquid Unit Price	Liquid Subtotal Cost	Total Analytical Cost
Implementation																	
Baseline Sampling - Assume 60 existing Surficial Aquifer monitoring wells for COCs and other technology-performance monitoring analyses																	
Groundwater wells																	
TCL VOCs by CLP OLM04.3	GW	60	6	12	3	12	5	5					103	103	$21.63	$2,227.89	$2,227.89
Methane, Ethane, Ethene by RSK-175	GW	60	0	0	0	0	3	3					66	66	$15.14	$999.24	$999.24
Nitrate, Nitrite, Sulfate by USEPA 300.0	GW	60	0	0	0	0	3	3					66	66	$16.22	$1,070.52	$1,070.52
Sulfide by USEPA 376.1	GW	60	0	0	0	0	3	3					66	66	$5.41	$357.06	$357.06
Alkalinity by USEPA 310.1	GW	60	0	0	0	0	3	3					66	66	$5.41	$357.06	$357.06
Volatile Fatty Acids (VFAs) (Acetic, Butyric, Pyruvic, Propionic, and Lactic Acid) by AM23G	GW	60	0	0	0	0	3	3					66	66	$15.14	$999.24	$999.24
Total Organic Carbon (TOC) by SW-846 9060 Quadruplicate analysis	GW	60	0	0	0	0	3	3					66	66	$8.65	$570.90	$570.90
Dissolved Iron and Manganese by SW-846 6010B	GW	60	6	0	0	0	4	4					74	74	$6.49	$480.26	$480.26
																Baseline Subtotal	**$7,062.17**
Additional Baseline -- Assume 25 new wells: 15 new shallow and 10 new deep wells																	
Groundwater wells																	
TCL VOCs	GW	25	3	5	1	5	2	2					43	43	$21.63	$930.09	$930.09
Methane, Ethane, Ethene	GW	25	0	0	0	0	2	2					29	29	$15.14	$439.06	$439.06
Nitrate, Nitrite, Sulfate	GW	25	0	0	0	0	2	2					29	29	$16.22	$470.38	$470.38
Sulfide	GW	25	0	0	0	0	2	2					29	29	$5.41	$156.89	$156.89
Alkalinity	GW	25	0	0	0	0	2	2					29	29	$5.41	$156.89	$156.89
VFAs	GW	25	0	0	0	0	2	2					29	29	$15.14	$439.06	$439.06
TOC	GW	25	0	0	0	0	2	2					29	29	$8.65	$250.85	$250.85
Dissolved Iron and Manganese	GW	25	3	0	0	0	2	2					32	32	$6.49	$207.68	$207.68
																Additional Baseline Subtotal	**$3,050.90**
																TOTAL IMPLEMENTATION DV COST	**$10,113.07**
MNA Performance Monitoring / LTM																	
Assume sampling network consists of 50 monitoring wells																	
Months 9, 18, 27, and 36																	
Groundwater wells																	
TCL VOCs	GW	50	5	10	2	10	4	4					85	85	$21.63	$1,838.55	$1,838.55
Methane, Ethane, Ethene	GW	50	0	0	0	0	3	3					56	56	$15.14	$847.84	$847.84
Nitrate, Nitrite, Sulfate	GW	50	0	0	0	0	3	3					56	56	$16.22	$908.32	$908.32
Sulfide	GW	50	0	0	0	0	3	3					56	56	$5.41	$302.96	$302.96
Alkalinity	GW	50	0	0	0	0	3	3					56	56	$5.41	$302.96	$302.96
VFAs	GW	50	0	0	0	0	3	3					56	56	$15.14	$847.84	$847.84
TOC	GW	50	0	0	0	0	3	3					56	56	$8.65	$484.40	$484.40
Dissolved Iron and Manganese	GW	50	5	0	0	0	3	3					61	61	$6.49	$395.89	$395.89
																Subtotal	**$5,928.76**
																Total for 9,18,27&36 months	**$23,715.04**
Years 5, 10, and 15																	
Groundwater wells																	
TCL VOCs	GW	50	5	10	2	10	4	4					85	85	$21.63	$1,838.55	$1,838.55
Methane, Ethane, Ethene	GW	50	0	0	0	0	3	3					56	56	$15.14	$847.84	$847.84
Nitrate, Nitrite, Sulfate	GW	50	0	0	0	0	3	3					56	56	$16.22	$908.32	$908.32
Sulfide	GW	50	0	0	0	0	3	3					56	56	$5.41	$302.96	$302.96
Alkalinity	GW	50	0	0	0	0	3	3					56	56	$5.41	$302.96	$302.96
VFAs	GW	50	0	0	0	0	3	3					56	56	$15.14	$847.84	$847.84
TOC	GW	50	0	0	0	0	3	3					56	56	$8.65	$484.40	$484.40
Dissolved Iron and Manganese	GW	50	5	0	0	0	3	3					61	61	$6.49	$395.89	$395.89
																Subtotal	**$5,928.76**
																Total for 5+10+15	**$17,786.28**
Years 20, 25, 30… and 100 (only VOC analysis)																	
Groundwater wells																	
TCL VOCs	GW	50	5	10	2	10	4	4					85	85	$21.63	$1,838.55	$1,838.55
																Subtotal	**$1,838.55**
																Total for 20+25+30+35…+95+100	**$29,416.80**
																TOTAL FUTURE DV COST	**$70,918.12**

Table C-4 - Cost Estimate for Alternative 4 - Biosparge, MNA, and LUCs
OU14, Site 90 Feasibility Study, MCAS Cherry Point, North Carolina

Assumptions:
LUC RD prepared by contractor. 5YR performed with other MCAS Cherry Point sites. Quarterly inspections performed by contractor. Well maintenance required every 5yrs.
Baseline sampling of 60 wells for COCs and geochemical and biodegradation-related analyses.
Following review of baseline data, install 30 new monitoring wells: 17 shallow at 15-35 ft bgs and 13 deep at 35-50 ft bgs. Sample these for additional baseline data (COCs and geochem/biodeg analyses).
MNA performance monitoring corresponds to biosparge system operation: 55 wells. Quarterly during Years 1&2. Annual Years 3-5. Annual Year 10. Quarterly Years 11&12. Annual Years 13-15. Annual on Years 20, 25, 30, 35, & 40.

Item/Activity	Qty	Unit	Unit Cost	Cost	Notes & Comments
IMPLEMENTATION COST					
LUCs					
LUC Remedial Design and implementation into MCAS Cherry Point's plan & GIS, and into Navy's *LUC Tracker*.	1	each	$8,000	$8,000	Includes Draft and Final LUC Plans. Assume contractor prepares LUC RD.
UFP-SAP & Remedial Action Work Plan					
Work Plan for additional sampling, well installation, sparge operation, and groundwater performance monitoring (in Navy's UFP SAP format).	1	each	$40,000	$40,000	Pre-Draft, Draft, Draft Final, & Final. Includes Scoping sessions. Recent similar project.
Baseline Sampling (60 existing Wells)					
Labor, ODCs, travel	1	event	$21,000	$21,000	Assume sample 60 wells. TBD by Team.
Lab & Data Validation	1	each	$46,524	$46,524	See lab & DV backup sheets
Equipment	1	event	$4,400	$4,400	
Report	1	each	$8,000	$8,000	
New Well Installation (30 new wells)					
Labor, ODCs, travel	1	event	$19,000	$19,000	17 shallow (15-35 ft bgs) and 13 deep (35-50 ft bgs) new monitoring wells. TBD by Team.
Utility Location	1	LS	$2,000	$2,000	
Drilling Subcontractor / well installation	1,245	LF	$100	$124,500	Includes mob, materials, labor
Survey	1	each	$2,000	$2,000	
Sample New Wells (30 wells)					
Labor, ODCs, travel	1	each	$11,000	$11,000	
Lab & Data Validation	1	each	$23,555	$23,555	
Equipment	1	event	$2,400	$2,400	
Report	1	each	$8,000	$8,000	
HDD Biosparge System Installation & Startup					
Equipment and Subcontractor					
Mobilization and Site Setup	1	EA	$5,000	$5,000	
Utility Location	1	LS	$2,000	$2,000	
Installation of HDD biosparge wells (4) to 45 feet bgs	3,230	LF	$120	$387,600	Based on verbal estimate by Trenchless Specialties (including decon, IDW containerization, and well development). Assumes 1,630 feet of slotted pipe and 1,600 feet of blank casing, three double ended wells w/ 225 feet of casing each side, one blind well w/ 250 ft of casing.
HDPE Casing (4" HDPE) + freight	1,600	LF	$8	$12,800	Based on verbal estimate by PQ Products
HDPE Custom Slotted Well Screen + freight	1,630	LF	$15	$24,450	Based on verbal estimate by PQ Products
HDPE Conveyance Piping Materials, Trenching, and Installation	350	LF	$35	$12,250	Engineer's Estimate
Transport & Disposal of Soil Cuttings	8	rolloff	$2,400	$19,200	(8) 20CY rolloffs with transport & disposal
50 HP Screw Air Compressor, 400 gallon receiver, condensate system, etc	3	ea	$19,500	$58,500	Based on verbal estimate by Dominion Air and Machinery
30 HP Screw Air Compressor, 400 gallon receiver, condensate system, etc	1	ea	$14,500	$14,500	Based on verbal estimate by Dominion Air and Machinery
8' x 20' Shipping Container w/ HVAC and Interior Manifold (no slab)	4	ea	$24,500	$98,000	Based on verbal estimate by Dominion Air and Machinery
Three-way motorized valve and analog timer (air cycling control)	4	ea	$2,500	$10,000	Based on verbal estimate by Dominion Air and Machinery
Electrical Power Drop, 460 V/3 ph/200 A Service, Transformers, Poles	4	LS	$20,000	$80,000	Recent similar project at Camp Lejeune Site 86
Final Electrical Connections, Installation of Service Panel and Disconnect	4	LS	$6,000	$24,000	Recent similar project at Camp Lejeune Site 86
Equipment Delivery	4	ea	$3,000	$12,000	
Misc Piping, Fittings, Materials	1	LS	$3,000	$3,000	
Post Construction Site Survey	1	LS	$4,500	$4,500	
System Startup					
Labor	2	week	$7,500	$15,000	
Startup Equipment Rental	2	week	$300	$600	
Travel and Perdiem	2	week	$2,000	$4,000	
Construction Report	1	each	$12,000	$12,000	Draft and Final Construction Completion Report
Subtotal				*$1,119,779*	
Contingency	*25%*			*$279,945*	
Project Management	*10%*			*$111,978*	
Remedial Design	*10%*			*$111,978*	
G&A	*7%*			*$78,385*	
Overhead & Profit	*8%*			*$89,582*	
			Total Implementation Cost	**$1,791,646**	
FUTURE COSTS (40 years)					
LUCs (Years 1-40)					
IR Quarterly Inspections and reporting (4 per year)	40	year	$16,000	$640,000	4 inspections per year at $4,000 per inspection -- for 40 yrs. Assume contractor performs site inspections and reporting.
Subtotal			*$16,000*	*$640,000*	
Project Management	*10%*		*$1,600*	*$64,000*	
Subtotal			*$17,600*	*$704,000*	
LUCs Future Annual Cost			$17,600		
LUCs Total Future Cost				$704,000	

Table C-4 - Cost Estimate for Alternative 4 - Biosparge, MNA, and LUCs
OU14, Site 90 Feasibility Study, MCAS Cherry Point, North Carolina

Item/Activity	Qty	Unit	Unit Cost	Cost	Notes & Comments
Present Value (2.7%) of Future Cost of LUCs	*40*	*year*	*2.7%*	*$427,292*	*Y2009 PV calculated for 40-yrs-future-cost using 2.7% Real Discount Rate per Office of Management and Budget (2008) guidance.*
5-Year Reviews (Years 5, 10, 15… and 40)					
5-Year Review	8	each	$10,000	$108,000	5YR conducted once every 5 years. To be conducted in conjunction with other post-ROD sites at MCAS Cherry Point. Years, 5, 10… and 40. Includes pre-draft, draft, draft final, final, fact sheet, and public notices.
Subtotal			*$10,000*	*$108,000*	
Contingency	*10%*		*$1,000*	*$10,800*	
Project Management	*10%*		*$1,000*	*$10,800*	
General Conditions and Administration	*7%*		*$700*	*$7,560*	
Overhead & Profit	*8%*		*$800*	*$8,640*	
Subtotal			*$13,500*	*$145,800*	
5YR Total Annual Cost at Years 5, 10… and 40)			$13,500		
5YR Total Future Cost				$145,800	
Present Value (2.7%) of Future Cost of 5YRs	*40*	*year*	*2.7%*	*$62,105*	
Well Maintenance (Years 5, 10, 15… and 35)					
Repair flushmounts & vaults, potential well replacements, etc.	7	event	$15,000	$105,000	Assume well repairs needed approximately every 5 years.
Subtotal			*$15,000*	*$105,000*	
Contingency	*20%*		*$3,000*	*$21,000*	
Project Management	*10%*		*$1,500*	*$10,500*	
General Conditions and Administration	*7%*		*$1,050*	*$7,350*	
Overhead & Profit	*8%*		*$1,200*	*$8,400*	
Subtotal			*$21,750*	*$152,250*	
Well Maintenance Future Annual Cost at Years 5, 10… and 35)			$21,750		
Subtotal				$152,250	
Present Value (2.7%) of Future Cost of Well Maintenance	*35*	*year*	*2.7%*	*$95,563*	
Well Abandonment (Year 40)					
Abandon wells when RAOs are achieved. Driller sub.	90	well	$300	$27,000	Assume well abandonment will occur at Year 40.
Labor	4	week	$7,500	$30,000	assume abandon all IR Program wells
Travel & per diem	4	week	$2,000	$8,000	
Subtotal				*$65,000*	
Contingency	*20%*			*$13,000*	
Project Management	*10%*			*$6,500*	
General Conditions and Administration	*7%*			*$4,550*	
Overhead & Profit	*8%*			*$5,200*	
Subtotal				*$94,250*	
Present Value (2.7%) of Future Cost of Well Abandonment	*40*	*year*	*2.7%*	*$32,469*	
Biosparge System O&M Years 1 & 2					Operate for 2 years then shut down. Can start again in the future depending on future performance data. In this alternative, assume re-start at beginning of Year 11, operating for 2 years then shut down.
Year 1 O&M					
Weekly System Checks for First Month	4	events	$850	$3,400	
Monthly O&M Labor + Travel	12	events	$950	$11,400	
Quarterly "Heavy" Maintenance	4	events	$1,600	$6,400	
O&M Supplies	1	LS	$2,000	$2,000	
Electrical usage ($0.075/kw-hr, 180 hp peak motor rating)	1	year	$94,047	$94,047	Power cost assumes $0.08/kW-hr
Subtotal				*$117,247*	
Contingency	*15%*			*$17,587*	
Project Management	*10%*			*$11,725*	
General Conditions and Administration	*7%*			*$8,207*	
Overhead & Profit	*8%*			*$9,380*	
Year 1 Subtotal				*$164,146*	
Year 2 O&M					
Monthly O&M Labor + Travel	12	events	$950	$11,400	
Quarterly "Heavy" Maintenance	4	events	$1,600	$6,400	
O&M Supplies	1	LS	$2,000	$2,000	
Electrical usage ($0.075/kw-hr, 180 hp peak motor rating)	1	year	$94,047	$94,047	Power cost assumes $0.08/kW-hr
Subtotal				*$113,847*	
Contingency	*25%*			*$28,462*	
Project Management	*10%*			*$11,385*	
General Conditions and Administration	*7%*			*$7,969*	
Overhead & Profit	*8%*			*$9,108*	
Year 2 Subtotal				*$170,771*	
Subtotal Years 1 & 2				*$334,916*	
Present Value (2.7%) of Future Cost of Biosparge O&M Years 1&2			*2.7%*	*$326,055*	
Shut down at end of Year 2 (after 2 years of operation)					Assume shut down system after 2yrs operation. Continue performance monitoring.
Biosparge System O&M Years 11 & 12					Assume system is started again at beginning of Year 11. Run for 2 yrs.
Year 11 System Startup					
Labor	2	week	$7,500	$15,000	
Startup Equipment Rental	2	week	$300	$600	
Travel and Perdiem	2	week	$2,000	$4,000	
Subtotal				*$19,600*	
Year 11 O&M					
Weekly System Checks for First Month	4	events	$850	$3,400	

Table C-4 - Cost Estimate for Alternative 4 - Biosparge, MNA, and LUCs
OU14, Site 90 Feasibility Study, MCAS Cherry Point, North Carolina

Item/Activity	Qty	Unit	Unit Cost	Cost	Notes & Comments
Monthly O&M Labor + Travel	12	events	$950	$11,400	
Quarterly "Heavy" Maintenance	4	events	$1,600	$6,400	
O&M Supplies	1	LS	$2,000	$2,000	
Electrical usage ($0.075/kw-hr, 180 hp peak motor rating)	1	year	$94,047	$94,047	Power cost assumes $0.08/kW-hr
Subtotal				*$117,247*	
Subtotal				*$136,847*	
Contingency	*25%*			*$34,212*	
Project Management	*10%*			*$13,685*	
General Conditions and Administration	*7%*			*$9,579*	
Overhead & Profit	*8%*			*$10,948*	
Year 11 Subtotal				*$205,271*	
Years 12 O&M					
Monthly O&M Labor + Travel	12	events	$950	$11,400	
Quarterly "Heavy" Maintenance	4	events	$1,600	$6,400	
O&M Supplies	1	LS	$2,000	$2,000	
Electrical usage ($0.075/kw-hr, 180 hp peak motor rating)	1	year	$94,047	$94,047	Power cost assumes $0.08/kW-hr
Subtotal				*$113,847*	
Contingency	*25%*			*$28,462*	
Project Management	*10%*			*$11,385*	
General Conditions and Administration	*7%*			*$7,969*	
Overhead & Profit	*8%*			*$9,108*	
Year 12 Subtotal				*$170,771*	
Present Value (2.7%) of Future Cost of Biosparge O&M Years 11&12			*2.7%*	*$277,169*	
Shut down at end of Year 12 (after 2 years of operation)					Assume shut down at end of Year 12 (after 2yrs operation). Continue performance monitoring.
Performance Groundwater Monitoring (55 wells)					
Years 1&2 (Quarterly events)					
Labor, ODCs, travel	8	event	$18,000	$144,000	Assume 55 wells in performance monitoring program. TBD by Team.
Lab & Data Validation	8	each	$43,157	$345,259	See lab & DV backup sheets
Equipment	8	event	$4,000	$32,000	
Report	8	each	$8,000	$64,000	
Subtotal			*$73,157.42*	*$585,259.36*	
Contingency	*15%*		*$10,974*	*$87,789*	
Project Management	*10%*		*$7,316*	*$58,526*	
G&A	*7%*		*$5,121*	*$40,968*	
Overhead & Profit	*8%*		*$5,853*	*$46,821*	
Subtotal			*$102,420*	*$819,363*	*$100,308 per event*
Present Value (2.7%) of Future Cost of Groundwater Sampling Years 1&2			*2.7%*	*$787,334*	
Years 3-5 (annual) (55 wells)					
Labor, ODCs, travel	3	event	$18,000	$54,000	Assume 50 wells in performance monitoring program. TBD by Team.
Lab & Data Validation	3	each	$39,185	$117,556	See lab & DV backup sheets
Equipment	3	event	$4,000	$12,000	
Report	3	each	$8,000	$24,000	
Subtotal			*$69,185.32*	*$207,555.96*	
Contingency	*15%*		*$10,378*	*$31,133*	
Project Management	*10%*		*$6,919*	*$20,756*	
G&A	*7%*		*$4,843*	*$14,529*	
Overhead & Profit	*8%*		*$5,535*	*$16,604*	
Subtotal			*$96,859*	*$290,578*	
Present Value (2.7%) of Future Cost of Groundwater Sampling Years 3-5			*2.7%*	*$261,267*	
Year 10 (50 wells)					
Labor, ODCs, travel	1	event	$15,000	$15,000	Assume 50 wells in performance monitoring program. TBD by Team.
Lab & Data Validation	1	each	$12,720	$12,720	See lab & DV backup sheets
Equipment	1	event	$3,600	$3,600	
Report	1	each	$8,000	$8,000	
Subtotal			*$39,320*	*$39,320.14*	
Contingency	*20%*		*$7,864*	*$7,864*	
Project Management	*10%*		*$3,932*	*$3,932*	
G&A	*7%*		*$2,752*	*$2,752*	
Overhead & Profit	*8%*		*$3,146*	*$3,146*	
Subtotal			*$57,014*	*$57,014*	
Present Value (2.7%) of Future Cost of Groundwater Sampling Year 10			*2.7%*	*$43,680*	
Years 11&12 (Quarterly events) (55 wells)					
Labor, ODCs, travel	8	event	$18,000	$144,000	Assume 55 wells in performance monitoring program. TBD by Team.
Lab & Data Validation	8	each	$43,185	$345,478	See lab & DV backup sheets
Equipment	8	event	$4,000	$32,000	
Report	8	each	$8,000	$64,000	
Subtotal			*$73,184.72*	*$585,477.76*	
Contingency	*20%*		*$14,631*	*$117,052*	
Project Management	*10%*		*$7,316*	*$58,526*	
G&A	*7%*		*$5,121*	*$40,968*	
Overhead & Profit	*8%*		*$5,853*	*$46,821*	
Subtotal			*$106,106*	*$848,844*	*$100,308 per event*
Present Value (2.7%) of Future Cost of Groundwater Sampling Years 11&12			*2.7%*	*$624,894*	
Years 13-15 (annual) (55 wells)					
Labor, ODCs, travel	3	event	$18,000	$54,000	Assume 50 wells in performance monitoring program. TBD by Team.
Lab & Data Validation	3	each	$43,185	$129,554	See lab & DV backup sheets
Equipment	3	event	$4,000	$12,000	
Report	3	each	$8,000	$24,000	
Subtotal			*$73,184.72*	*$219,554.16*	

Table C-4 - Cost Estimate for Alternative 4 - Biosparge, MNA, and LUCs
OU14, Site 90 Feasibility Study, MCAS Cherry Point, North Carolina

Item/Activity	Qty	Unit	Unit Cost	Cost	Notes & Comments
Contingency	*20%*		*$13,837*	*$41,511*	
Project Management	*10%*		*$6,919*	*$20,756*	
G&A	*7%*		*$4,843*	*$14,529*	
Overhead & Profit	*8%*		*$5,535*	*$16,604*	
Subtotal			*$104,318*	*$312,954*	
Present Value (2.7%) of Future Cost of Groundwater Sampling Years 13-15			*2.7%*	*$215,575*	
Year 20, 25… and 40 (50 wells)					
Labor, ODCs, travel	5	event	$15,000	$75,000	Assume 50 wells in performance monitoring program. TBD by Team.
Lab & Data Validation	5	each	$12,720	$63,601	See lab & DV backup sheets
Equipment	5	event	$3,600	$18,000	
Report	5	each	$8,000	$40,000	
Subtotal			*$39,320.14*	*$196,600.70*	
Contingency	*20%*		*$7,864*	*$7,864*	
Project Management	*10%*		*$3,932*	*$3,932*	
G&A	*7%*		*$2,752*	*$2,752*	
Overhead & Profit	*8%*		*$3,146*	*$3,146*	
Subtotal			*$57,014*	*$214,295*	
Present Value (2.7%) of Future Cost of Groundwater Sampling Years 20,25...&40			*2.7%*	*$130,472*	
Total Present Value (2.7%) of All Future Costs			**2.7%**	**$3,283,874**	Y2009 PV calculated for 40-yrs-future-cost using 2.7% Real Discount Rate per Office of Management and Budget (2008) guidance.
TOTAL PV Cost of Alternative 3 - MNA and LUCs			*-30%*	*+50%*	
Using 2.7% Discount Rate for PV of Future Costs	**$5,075,520**		*$3,552,864*	*$7,613,281*	

Other Notes and References:

● The "Real" Discount Rate used to calculate the Present Value cost is 2.7% for a 40-year timeframe per the Office of Management and Budget (OMB), Circular A-94, Appendix C, Revised December 2008, "Discount Rates for Cost Effectiveness, Lease Purchase, and Related Analysis" for Calendar Year 2009, http://www.whitehouse.gov/omb/circulars_a094_a94_appx-c/.

The Real Discount Rates are a forecast of real interest rates from which the inflation premium has been removed and based on the economic assumptions from the December 2010 Budget Baseline. These real rates are to be used for discounting constant-dollar flows, as is often required in cost-effectiveness analysis.

● USEPA. 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* . OSWER Directive 9355.3-01. EPA/540/G-89/004. October.

● USEPA. 2000. *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study* . With the U.S. Army Corps of Engineers. OSWER 9355.0-75. EPA 540-R-00-002. July.

● The information in this cost estimate is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during Baseline Sampling and the Remedial Design phase. This is an order-of-magnitude engineering cost estimate that is expected to be within –30 to +50 percent of the actual project cost (per USEPA, 1988 and 2000).

Alternative 4 - Biosparge, MNA, and LUCs
Lab Backup
OU14 FS, MCAS Cherry Point

Analysis/Test	Sample Matrix	Field Samples	Field Duplicates	Equipment Rinsate Blanks	Field Blanks	Trip Blanks	Matrix Spike	Matrix Spike Duplicate	Total Number of Solid Samples	Total Billable Solid Samples	Solid Unit Price	Solid Subtotal Cost	Total Number of Liquid Samples	Total Billable Liquid Samples	Liquid Unit Price	Liquid Subtotal Cost	Total Analytical Cost
Implementation																	
Baseline Sampling - Assume 60 existing Surficial Aquifer monitoring wells for COCs and other technology-performance monitoring analyses																	
Groundwater wells																	
TCL VOCs by CLP OLM04.3	GW	60	6	12	3	12	5	5					103	103	$111.71	$11,506.13	$11,506.13
Methane, Ethane, Ethene by RSK-175	GW	60	0	0	0	0	3	3					66	66	$105.18	$6,941.88	$6,941.88
Nitrate, Nitrite, Sulfate by USEPA 300.0	GW	60	0	0	0	0	3	3					66	66	$50.87	$3,357.42	$3,357.42
Sulfide by USEPA 376.1	GW	60	0	0	0	0	3	3					66	66	$35.12	$2,317.92	$2,317.92
Alkalinity by USEPA 310.1	GW	60	0	0	0	0	3	3					66	66	$13.73	$906.18	$906.18
Volatile Fatty Acids (VFAs) (Acetic, Butyric, Pyruvic, Propionic, and Lactic Acid) by AM23G	GW	60	0	0	0	0	3	3					66	66	$134.90	$8,903.40	$8,903.40
Total Organic Carbon (TOC) by SW-846 9060 Quadruplicate analysis	GW	60	0	0	0	0	3	3					66	66	$33.21	$2,191.86	$2,191.86
Dissolved Iron and Manganese by SW-846 6010B	GW	60	6	0	0	0	4	4					74	74	$35.73	$2,644.02	$2,644.02
IDW - Purged groundwater and decon water														0			
Full TCLP (1311/ 8260B, 8270C, 8151A, 6010B, 7470A, 8081A, 8082)	Aqueous	1											1	1	$657.00	$657.00	$657.00
Corrosivity as pH by SW-846 9045C	Aqueous	1											1	1	$8.82	$8.82	$8.82
Ignitability by Pensky Martens	Aqueous	1											1	1	$27.30	$27.30	$27.30
																Baseline Subtotal	**$39,461.93**
Additional Baseline -- Assume 30 new wells: 17 new shallow and 13 new deep wells																	
Groundwater wells																	
TCL VOCs	GW	30	3	6	2	6	3	3					53	53	$95.00	$5,035.00	$5,035.00
Methane, Ethane, Ethene	GW	30	0	0	0	0	2	2					34	34	$101.09	$3,437.06	$3,437.06
Nitrate, Nitrite, Sulfate	GW	30	0	0	0	0	2	2					34	34	$48.82	$1,659.88	$1,659.88
Sulfide	GW	30	0	0	0	0	2	2					34	34	$21.91	$744.94	$744.94
Alkalinity	GW	30	0	0	0	0	2	2					34	34	$13.18	$448.12	$448.12
VFAs	GW	30	0	0	0	0	2	2					34	34	$128.57	$4,371.38	$4,371.38
TOC	GW	30	0	0	0	0	2	2					34	34	$33.21	$1,129.14	$1,129.14
Dissolved Iron and Manganese	GW	30	3	0	0	0	2	2					37	37	$28.08	$1,038.96	$1,038.96
IDW - (1) Soil cuttings from new well installations;																	
Full TCLP		2							1	1	$639.00	$639.00	2	2	$657.00	$1,314.00	$1,953.00
Corrosivity	Aqueous	2							1	1	$11.28	$11.28	2	2	$8.45	$16.90	$28.18
Ignitability	& Solid	2							1	1	$26.87	$26.87	2	2	$26.30	$52.60	$79.47
																Additional Baseline Subtotal	**$19,925.13**
																TOTAL IMPLEMENTATION LAB COST	**$59,387.06**
Biosparge & MNA Performance Monitoring / LTM																	
Assume sampling network consists of up to 55 monitoring wells (depending on event)																	
Years 1&2 - Quarterly Sampling Event																	
Groundwater wells																	
TCL VOCs	GW	55	6	11	3	11	5	5					96	96	$111.71	$10,724.16	$10,724.16
Methane, Ethane, Ethene	GW	55	0	0	0	0	3	3					61	61	$105.18	$6,415.98	$6,415.98
Nitrate, Nitrite, Sulfate	GW	55	0	0	0	0	3	3					61	61	$50.87	$3,103.07	$3,103.07
Sulfide	GW	55	0	0	0	0	3	3					61	61	$35.12	$2,142.32	$2,142.32
Alkalinity	GW	55	0	0	0	0	3	3					61	61	$13.73	$837.53	$837.53
VFAs	GW	55	0	0	0	0	3	3					61	61	$134.90	$8,228.90	$8,228.90
TOC	GW	55	0	0	0	0	3	3					61	61	$33.21	$2,025.81	$2,025.81
Dissolved Iron and Manganese	GW	55	6	0	0	0	4	4					69	69	$35.73	$2,465.37	$2,465.37
IDW - Purged groundwater and decon water																	
Full TCLP (1311/ 8260B, 8270C, 8151A, 6010B, 7470A, 8081A, 8082)	Aqueous	1											1	1	$657.00	$657.00	$657.00
Corrosivity as pH by SW-846 9045C	Aqueous	1											1	1	$8.82	$8.82	$8.82
Ignitability by Pensky Martens	Aqueous	1											1	1	$27.30	$27.30	$27.30
																Subtotal per event	**$36,608.96**
																Total for Years 1+2	**$292,871.68**
Years 3-5 (annual)																	
Groundwater wells																	
TCL VOCs	GW	50	5	10	2	10	4	4					85	85	$111.71	$9,495.35	$9,495.35
Methane, Ethane, Ethene	GW	50	0	0	0	0	3	3					56	56	$105.18	$5,890.08	$5,890.08
Nitrate, Nitrite, Sulfate	GW	50	0	0	0	0	3	3					56	56	$50.87	$2,848.72	$2,848.72
Sulfide	GW	50	0	0	0	0	3	3					56	56	$35.12	$1,966.72	$1,966.72
Alkalinity	GW	50	0	0	0	0	3	3					56	56	$13.73	$768.88	$768.88
VFAs	GW	50	0	0	0	0	3	3					56	56	$134.90	$7,554.40	$7,554.40
TOC	GW	50	0	0	0	0	3	3					56	56	$33.21	$1,859.76	$1,859.76
Dissolved Iron and Manganese	GW	50	5	0	0	0	3	3					61	61	$35.73	$2,179.53	$2,179.53

Alternative 4 - Biosparge, MNA, and LUCs
Lab Backup
OU14 FS, MCAS Cherry Point

Analysis/Test	Sample Matrix	Field Samples	Field Duplicates	Equipment Rinsate Blanks	Field Blanks	Trip Blanks	Matrix Spike	Matrix Spike Duplicate	Total Number of Solid Samples	Total Billable Solid Samples	Solid Unit Price	Solid Subtotal Cost	Total Number of Liquid Samples	Total Billable Liquid Samples	Liquid Unit Price	Liquid Subtotal Cost	Total Analytical Cost
IDW - Purged groundwater and decon water																	
Full TCLP (1311/ 8260B, 8270C, 8151A, 6010B, 7470A, 8081A, 8082)	Aqueous	1											1	1	$657.00	$657.00	$657.00
Corrosivity as pH by SW-846 9045C	Aqueous	1											1	1	$8.82	$8.82	$8.82
Ignitability by Pensky Martens	Aqueous	1											1	1	$27.30	$27.30	$27.30
																Subtotal per event	**$33,256.56**
																Total for Years 3+4+5	**$99,769.68**
Year 10																	
Groundwater wells																	
TCL VOCs	GW	50	5	10	2	10	4	4					85	85	$111.71	$9,495.35	$9,495.35
IDW - Purged groundwater and decon water																	
Full TCLP (1311/ 8260B, 8270C, 8151A, 6010B, 7470A, 8081A, 8082)	Aqueous	1											1	1	$657.00	$657.00	$657.00
Corrosivity as pH by SW-846 9045C	Aqueous	1											1	1	$8.82	$8.82	$8.82
Ignitability by Pensky Martens	Aqueous	1											1	1	$27.30	$27.30	$27.30
																Subtotal	**$10,188.47**
																Total for Year 10	**$10,188.47**
Years 11&12 - Quarterly Sampling Event																	
Groundwater wells																	
TCL VOCs	GW	55	6	11	3	11	5	5					96	96	$111.71	$10,724.16	$10,724.16
Methane, Ethane, Ethene	GW	55	0	0	0	0	3	3					61	61	$105.18	$6,415.98	$6,415.98
Nitrate, Nitrite, Sulfate	GW	55	0	0	0	0	3	3					61	61	$50.87	$3,103.07	$3,103.07
Sulfide	GW	55	0	0	0	0	3	3					61	61	$35.12	$2,142.32	$2,142.32
Alkalinity	GW	55	0	0	0	0	3	3					61	61	$13.73	$837.53	$837.53
VFAs	GW	55	0	0	0	0	3	3					61	61	$134.90	$8,228.90	$8,228.90
TOC	GW	55	0	0	0	0	3	3					61	61	$33.21	$2,025.81	$2,025.81
Dissolved Iron and Manganese	GW	55	6	0	0	0	4	4					69	69	$35.73	$2,465.37	$2,465.37
IDW - Purged groundwater and decon water														0			
Full TCLP (1311/ 8260B, 8270C, 8151A, 6010B, 7470A, 8081A, 8082)	Aqueous	1											1	1	$657.00	$657.00	$657.00
Corrosivity as pH by SW-846 9045C	Aqueous	1											1	1	$8.82	$8.82	$8.82
Ignitability by Pensky Martens	Aqueous	1											1	1	$27.30	$27.30	$27.30
																Subtotal per event	**$36,636.26**
																Total for Years 11+12	**$293,090.08**
Years 13-15 (annual)																	
Groundwater wells																	
TCL VOCs	GW	55	6	11	3	11	5	5					96	96	$111.71	$10,724.16	$10,724.16
Methane, Ethane, Ethene	GW	55	0	0	0	0	3	3					61	61	$105.18	$6,415.98	$6,415.98
Nitrate, Nitrite, Sulfate	GW	55	0	0	0	0	3	3					61	61	$50.87	$3,103.07	$3,103.07
Sulfide	GW	55	0	0	0	0	3	3					61	61	$35.12	$2,142.32	$2,142.32
Alkalinity	GW	55	0	0	0	0	3	3					61	61	$13.73	$837.53	$837.53
VFAs	GW	55	0	0	0	0	3	3					61	61	$134.90	$8,228.90	$8,228.90
TOC	GW	55	0	0	0	0	3	3					61	61	$33.21	$2,025.81	$2,025.81
Dissolved Iron and Manganese	GW	55	6	0	0	0	4	4					69	69	$35.73	$2,465.37	$2,465.37
IDW - Purged groundwater and decon water																	
Full TCLP (1311/ 8260B, 8270C, 8151A, 6010B, 7470A, 8081A, 8082)	Aqueous	1											1	1	$657.00	$657.00	$657.00
Corrosivity as pH by SW-846 9045C	Aqueous	1											1	1	$8.82	$8.82	$8.82
Ignitability by Pensky Martens	Aqueous	1											1	1	$27.30	$27.30	$27.30
																Subtotal per event	**$36,636.26**
																Total for Years 13+14+15	**$109,908.78**
Years 20, 25, 30, 35, and 40																	
Groundwater wells																	
TCL VOCs	GW	50	5	10	2	10	4	4					85	85	$111.71	$9,495.35	$9,495.35
IDW - Purged groundwater and decon water																	
Full TCLP (1311/ 8260B, 8270C, 8151A, 6010B, 7470A, 8081A, 8082)	Aqueous	1											1	1	$657.00	$657.00	$657.00
Corrosivity as pH by SW-846 9045C	Aqueous	1											1	1	$8.82	$8.82	$8.82
Ignitability by Pensky Martens	Aqueous	1											1	1	$27.30	$27.30	$27.30
																Subtotal	**$10,188.47**
																Total for Years 20+25+30+35+40	**$50,942.35**
																TOTAL FUTURE LAB COST	**$856,771.04**

Full QA/QC for OU14 COCs only. Also, duplicates for metals. MS/MSDs are billable Standard turnaround time

Analysis/Test	Sample Matrix	Field Samples	Field Duplicates	Equipment Rinsate Blanks	Field Blanks	Trip Blanks	Matrix Spike	Matrix Spike Duplicate	Total Number of Solid Samples	Total Billable Solid Samples	Solid Unit Price	Solid Subtotal Cost	Total Number of Liquid Samples	Total Billable Liquid Samples	Liquid Unit Price	Liquid Subtotal Cost	Total Analytical Cost
Implementation																	
Baseline Sampling - Assume 60 existing Surficial Aquifer monitoring wells for COCs and other technology-performance monitoring analyses																	
Groundwater wells																	
TCL VOCs by CLP OLM04.3	GW	60	6	12	3	12	5	5					103	103	$21.63	$2,227.89	$2,227.89
Methane, Ethane, Ethene by RSK-175	GW	60	0	0	0	0	3	3					66	66	$15.14	$999.24	$999.24
Nitrate, Nitrite, Sulfate by USEPA 300.0	GW	60	0	0	0	0	3	3					66	66	$16.22	$1,070.52	$1,070.52
Sulfide by USEPA 376.1	GW	60	0	0	0	0	3	3					66	66	$5.41	$357.06	$357.06
Alkalinity by USEPA 310.1	GW	60	0	0	0	0	3	3					66	66	$5.41	$357.06	$357.06
Volatile Fatty Acids (VFAs) (Acetic, Butyric, Pyruvic, Propionic, and Lactic Acid) by AM23G	GW	60	0	0	0	0	3	3					66	66	$15.14	$999.24	$999.24
Total Organic Carbon (TOC) by SW-846 9060 Quadruplicate analysis	GW	60	0	0	0	0	3	3					66	66	$8.65	$570.90	$570.90
Dissolved Iron and Manganese by SW-846 6010B	GW	60	6	0	0	0	4	4					74	74	$6.49	$480.26	$480.26
																Baseline Subtotal	**$7,062.17**
Additional Baseline -- Assume 30 new wells: 17 new shallow and 13 new deep wells																	
Groundwater wells																	
TCL VOCs	GW	30	3	6	2	6	3	3					53	53	$21.63	$1,146.39	$1,146.39
Methane, Ethane, Ethene	GW	30	0	0	0	0	2	2					34	34	$15.14	$514.76	$514.76
Nitrate, Nitrite, Sulfate	GW	30	0	0	0	0	2	2					34	34	$16.22	$551.48	$551.48
Sulfide	GW	30	0	0	0	0	2	2					34	34	$5.41	$183.94	$183.94
Alkalinity	GW	30	0	0	0	0	2	2					34	34	$5.41	$183.94	$183.94
VFAs	GW	30	0	0	0	0	2	2					34	34	$15.14	$514.76	$514.76
TOC	GW	30	0	0	0	0	2	2					34	34	$8.65	$294.10	$294.10
Dissolved Iron and Manganese	GW	30	3	0	0	0	2	2					37	37	$6.49	$240.13	$240.13
																Additional Baseline Subtotal	**$3,629.50**
																TOTAL IMPLEMENTATION DV COST	**$10,691.67**
Biosparge & MNA Performance Monitoring / LTM																	
Assume sampling network consists of up to 55 monitoring wells (depending on event)																	
Years 1&2 - Quarterly Sampling Event																	
Groundwater wells																	
TCL VOCs	GW	55	6	11	3	11	5	5					96	96	$21.63	$2,076.48	$2,076.48
Methane, Ethane, Ethene	GW	55	0	0	0	0	3	3					61	61	$15.14	$923.54	$923.54
Nitrate, Nitrite, Sulfate	GW	55	0	0	0	0	3	3					61	61	$16.22	$989.42	$989.42
Sulfide	GW	55	0	0	0	0	3	3					61	61	$5.41	$330.01	$330.01
Alkalinity	GW	55	0	0	0	0	3	3					61	61	$5.41	$330.01	$330.01
VFAs	GW	55	0	0	0	0	3	3					61	61	$15.14	$923.54	$923.54
TOC	GW	55	0	0	0	0	3	3					61	61	$8.65	$527.65	$527.65
Dissolved Iron and Manganese	GW	55	6	0	0	0	4	4					69	69	$6.49	$447.81	$447.81
																Subtotal per event	**$6,548.46**
																Total for Years 1+2	**$52,387.68**
Years 3-5 (annual)																	
Groundwater wells																	
TCL VOCs	GW	55	6	11	3	11	5	5					96	96	$21.63	$2,076.48	$2,076.48
Methane, Ethane, Ethene	GW	55	0	0	0	0	3	3					61	61	$15.14	$923.54	$923.54
Nitrate, Nitrite, Sulfate	GW	55	0	0	0	0	3	3					61	61	$16.22	$989.42	$989.42
Sulfide	GW	55	0	0	0	0	3	3					61	61	$5.41	$330.01	$330.01
Alkalinity	GW	55	0	0	0	0	3	3					61	61	$5.41	$330.01	$330.01
VFAs	GW	55	0	0	0	0	3	3					61	61	$15.14	$923.54	$923.54
TOC	GW	55	0	0	0	0	3	3					61	61	$8.65	$527.65	$527.65
Dissolved Iron and Manganese	GW	55	6	0	0	0	4	4					69	69	$6.49	$447.81	$447.81
																Subtotal per event	**$6,548.46**
																Total for Years 3+4+5	**$19,645.38**
Year 10																	
Groundwater wells																	
TCL VOCs	GW	50	5	10	2	10	4	4					85	85	$21.63	$1,838.55	$1,838.55
IDW - Purged groundwater and decon water																	
Full TCLP (1311/ 8260B, 8270C, 8151A, 6010B, 7470A, 8081A, 8082)	Aqueous	1											1	1	$657.00	$657.00	$657.00
Corrosivity as pH by SW-846 9045C	Aqueous	1											1	1	$8.82	$8.82	$8.82
Ignitability by Pensky Martens	Aqueous	1											1	1	$27.30	$27.30	$27.30
																Subtotal	**$2,531.67**
																Total for Year 10	**$2,531.67**

Years 11&12 - Quarterly Sampling Event																	
Groundwater wells																	
TCL VOCs	GW	55	6	11	3	11	5	5					96	96	$21.63	$2,076.48	$2,076.48
Methane, Ethane, Ethene	GW	55	0	0	0	0	3	3					61	61	$15.14	$923.54	$923.54
Nitrate, Nitrite, Sulfate	GW	55	0	0	0	0	3	3					61	61	$16.22	$989.42	$989.42
Sulfide	GW	55	0	0	0	0	3	3					61	61	$5.41	$330.01	$330.01
Alkalinity	GW	55	0	0	0	0	3	3					61	61	$5.41	$330.01	$330.01
VFAs	GW	55	0	0	0	0	3	3					61	61	$15.14	$923.54	$923.54
TOC	GW	55	0	0	0	0	3	3					61	61	$8.65	$527.65	$527.65
Dissolved Iron and Manganese	GW	55	6	0	0	0	4	4					69	69	$6.49	$447.81	$447.81
																Subtotal per event	**$6,548.46**
																Total for Years 11+12	**$52,387.68**
Years 13-15 (annual)																	
Groundwater wells																	
TCL VOCs	GW	55	6	11	3	11	5	5					96	96	$21.63	$2,076.48	$2,076.48
Methane, Ethane, Ethene	GW	55	0	0	0	0	3	3					61	61	$15.14	$923.54	$923.54
Nitrate, Nitrite, Sulfate	GW	55	0	0	0	0	3	3					61	61	$16.22	$989.42	$989.42
Sulfide	GW	55	0	0	0	0	3	3					61	61	$5.41	$330.01	$330.01
Alkalinity	GW	55	0	0	0	0	3	3					61	61	$5.41	$330.01	$330.01
VFAs	GW	55	0	0	0	0	3	3					61	61	$15.14	$923.54	$923.54
TOC	GW	55	0	0	0	0	3	3					61	61	$8.65	$527.65	$527.65
Dissolved Iron and Manganese	GW	55	6	0	0	0	4	4					69	69	$6.49	$447.81	$447.81
																Subtotal per event	**$6,548.46**
																Total for Years 13+14+15	**$19,645.38**
Years 20, 25, 30, 35, and 40																	
Groundwater wells																	
TCL VOCs	GW	50	5	10	2	10	4	4					85	85	$21.63	$1,838.55	$1,838.55
IDW - Purged groundwater and decon water																	
Full TCLP (1311/ 8260B, 8270C, 8151A, 6010B, 7470A, 8081A, 8082)	Aqueous	1											1	1	$657.00	$657.00	$657.00
Corrosivity as pH by SW-846 9045C	Aqueous	1											1	1	$8.82	$8.82	$8.82
Ignitability by Pensky Martens	Aqueous	1											1	1	$27.30	$27.30	$27.30
																Subtotal	**$2,531.67**
																Total for Years 20+25+30+35+40	**$12,658.35**
																TOTAL FUTURE DV COST	**$159,256.14**

Table C-5 - Cost Estimate for Alternative 5 - ERD, MNA, and LUCs
OU14, Site 90 Feasibility Study, MCAS Cherry Point, North Carolina

Assumptions:
LUC RD prepared by contractor. 5YR performed with other MCAS Cherry Point sites. Quarterly inspections performed by contractor. Well maintenance required every 5yrs.
Baseline sampling of 60 wells for COCs and geochemical and biodegradation-related analyses.
Following review of baseline data, install 30 new monitoring wells: 17 shallow at 15-35 ft bgs and 13 deep at 35-50 ft bgs. Sample these for additional baseline data (COCs and geochem/biodeg analyses).
MNA performance monitoring: 60 wells. Quarterly during injection year followed by 4 annual events. Then every 5 years.
Permanent injection wells. Assume 58 injection locations (some shallow/deep pairs) spaced 25-ft on center. 15-ft radius of injection. 20-ft 0.020-slot continuous wrap screens.
Total 90 injection wells to install: 32 shallow/deep injection locations (64 injection wells), 9 deep-only injection locations, and 17 shallow-only injection locations.
Estimated Time to Complete 1 injection event = 35 days (4-well injection manifold; 15 gpm)
3 Injection events: Implementation and at Years 5 & 20. No bioaugmentation.
3,222 pounds of 60% emulsified oil injected per well. EOS® product assumed. Saturation dosage based on 0.002 lbs EOS® per lb soil in treatment area. Total oil concentrate and mixture/chase water injected per well = 10,575 gallons. See Dosage calculation sheet.

Item/Activity	Qty	Unit	Unit Cost	Cost	Notes & Comments
IMPLEMENTATION COST					
LUCs					
LUC Remedial Design and implementation into MCAS Cherry Point's plan & GIS, and into Navy's *LUC Tracker* .	1	each	$8,000	$8,000	Includes Draft and Final LUC Plans. Assume contractor prepares LUC RD.
UFP-SAP & Remedial Action Work Plan					
Work Plan for additional sampling, well installation, sparge operation, and groundwater performance monitoring (in Navy's UFP-SAP format).	1	each	$40,000	$40,000	Pre-Draft, Draft, Draft Final, & Final. Includes Scoping sessions. Recent similar project.
Baseline Sampling (60 existing Wells)					
Labor, ODCs, travel	1	event	$21,000	$21,000	Assume sample 60 wells. TBD by Team.
Lab & Data Validation	1	each	$46,524	$46,524	See lab & DV backup sheets
Equipment	1	event	$4,400	$4,400	
Report	1	each	$8,000	$8,000	
New Well Installation (30 new wells)					
Labor, ODCs, travel	1	event	$19,000	$19,000	17 shallow (15-35 ft bgs) and 13 deep (35-50 ft bgs) new monitoring wells. TBD by Team.
Utility Location	1	LS	$2,000	$2,000	
Drilling Subcontractor / well installation	1,245	LF	$100	$124,500	Includes mob, materials, labor
Survey	1	each	$2,000	$2,000	
Sample New Wells (30 wells)					
Labor, ODCs, travel	1	each	$11,000	$11,000	
Lab & Data Validation	1	each	$23,555	$23,555	
Equipment	1	event	$2,400	$2,400	
Report	1	each	$8,000	$8,000	
ERD Well Installation and Injection					
Well Installation					
Labor	7	week	$7,500	$52,500	
Utility Location	1	LS	$2,000	$2,000	
Drilling Subcontractor / well installation	3,765	LF	$75	$282,375	Includes mob, materials, labor
Survey	1	LS	$2,000	$2,000	
Travel and Perdiem	7	week	$2,000	$14,000	
Injection					
Labor, ODCs, Travel	7	week	$9,500	$66,500	M-F. 8hrs injection time per day.
Emulsified Oil material and delivery	693	drum	$922	$638,946	EOS®-598 brand. See dosage calculation sheet for dosage per well calc.
Construction Report	1	each	$12,000	$12,000	Draft and Final Construction Completion Report
Subtotal				*$1,390,700*	
Contingency	*25%*			*$347,675*	
Project Management	*10%*			*$139,070*	
Remedial Design	*10%*			*$139,070*	
G&A	*7%*			*$97,349*	
Overhead & Profit	*8%*			*$111,256*	
			Total Implementation Cost	**$2,225,120**	
FUTURE COSTS (60 years)					
LUCs (Years 1-60)					
IR Quarterly Inspections and reporting (4 per year)	60	year	$16,000	$960,000	4 inspections per year at $4,000 per inspection -- for 60 yrs. Assume contractor performs site inspections and reporting.
Subtotal			*$16,000*	*$960,000*	
Project Management	*10%*		*$1,600*	*$96,000*	
Subtotal			*$17,600*	*$1,056,000*	
LUCs Future Annual Cost			$17,600		
LUCs Total Future Cost				$1,056,000	
Present Value (2.7%) of Future Cost of LUCs	*60*	*year*	*2.7%*	*$520,050*	*Y2009 PV calculated for 60-yrs-future-cost using 2.7% Real Discount Rate per Office of Management and Budget (2008) guidance.*
5-Year Reviews (Years 5, 10, 15… and 60)					
5-Year Review	8	each	$10,000	$108,000	5YR conducted once every 5 years. To be conducted in conjunction with other post-ROD sites at MCAS Cherry Point. Years, 5, 10… and 60. Includes pre-draft, draft, draft final, final, fact sheet, and public notices.
Subtotal			*$10,000*	*$108,000*	
Contingency	*10%*		*$1,000*	*$10,800*	
Project Management	*10%*		*$1,000*	*$10,800*	
General Conditions and Administration	*7%*		*$700*	*$7,560*	
Overhead & Profit	*8%*		*$800*	*$8,640*	
Subtotal			*$13,500*	*$145,800*	
5YR Total Annual Cost at Years 5, 10… and 60)			$13,500		
5YR Total Future Cost				$145,800	

Table C-5 - Cost Estimate for Alternative 5 - ERD, MNA, and LUCs
OU14, Site 90 Feasibility Study, MCAS Cherry Point, North Carolina

Item/Activity	Qty	Unit	Unit Cost	Cost	Notes & Comments
Present Value (2.7%) of Future Cost of 5YRs	*60*	*year*	*2.7%*	*$62,638*	
Well Maintenance (Years 5, 10, 15… and 55)					
Repair flushmounts & vaults, potential well replacements, etc.	11	event	$15,000	$165,000	Assume well repairs needed approximately every 5 years.
Subtotal			*$15,000*	*$165,000*	
Contingency	*20%*		*$3,000*	*$33,000*	
Project Management	*10%*		*$1,500*	*$16,500*	
General Conditions and Administration	*7%*		*$1,050*	*$11,550*	
Overhead & Profit	*8%*		*$1,200*	*$13,200*	
Subtotal			*$21,750*	*$239,250*	
Well Maintenance Future Annual Cost at Years 5, 10… and 55)			$21,750		
Present Value (2.7%) of Future Cost of Well Maintenance	*55*	*year*	*2.7%*	*$110,966*	
Well Abandonment (Year 60)					
Abandon wells when RAOs are achieved. Driller sub.	180	well	$300	$54,000	Assume well abandonment will occur at Year 60.
Labor	8	week	$7,500	$60,000	Includes injection wells
Travel & per diem	8	week	$2,000	$16,000	assume abandon all IR Program wells
Subtotal				*$130,000*	
Contingency	*20%*			*$26,000*	
Project Management	*10%*			*$13,000*	
General Conditions and Administration	*7%*			*$9,100*	
Overhead & Profit	*8%*			*$10,400*	
Subtotal				*$188,500*	
Present Value (2.7%) of Future Cost of Well Abandonment	*60*	*year*	*2.7%*	*$38,114*	
Reinjection at Years 5 & 20					
Labor, ODCs, Travel	7	week	$9,500	$66,500	M-F. 8hrs injection time per day.
Emulsified Oil material and delivery	693	drum	$922	$638,946	EOS®-598 brand. See dosage calculation sheet for dosage per well calc.
Subtotal each injection				*$705,446*	
Contingency	*25%*			*$176,362*	
Project Management	*10%*			*$70,545*	
General Conditions and Administration	*7%*			*$49,381*	
Overhead & Profit	*8%*			*$56,436*	
Subtotal each injection				*$1,058,169*	
Subtotal both injections				*$2,116,338*	
Present Value (2.7%) of Future Cost of Reinjections at Years 5 & 20			*2.7%*	*$1,547,274*	
Performance Groundwater Monitoring (60 wells)					
Years 1 & 21 (Quarterly events)					
Labor, ODCs, travel	8	event	$21,000	$168,000	Assume 55 wells in performance monitoring program. TBD by Team.
Lab & Data Validation	8	each	$46,524	$372,193	See lab & DV backup sheets
Equipment	8	event	$4,400	$35,200	
Report	8	each	$8,000	$64,000	
Subtotal			*$79,924.10*	*$639,392.80*	
Contingency	*15%*		*$11,989*	*$95,909*	
Project Management	*10%*		*$7,992*	*$63,939*	
G&A	*7%*		*$5,595*	*$44,757*	
Overhead & Profit	*8%*		*$6,394*	*$51,151*	
Subtotal			*$111,894*	*$895,150*	
Present Value (2.7%) of Future Cost of Groundwater Sampling Years 1 & 21			*2.7%*	*$871,616*	
Years 2-5, 20, and 22-25 (annual) (60 wells)					
Labor, ODCs, travel	9	event	$21,000	$189,000	Assume 50 wells in performance monitoring program. TBD by Team.
Lab & Data Validation	9	each	$46,524	$418,717	See lab & DV backup sheets
Equipment	9	event	$4,400	$39,600	
Report	9	each	$8,000	$72,000	
Subtotal			*$79,924.10*	*$719,316.90*	
Contingency	*20%*		*$15,985*	*$143,863*	
Project Management	*10%*		*$7,992*	*$71,932*	
G&A	*7%*		*$5,595*	*$50,352*	
Overhead & Profit	*8%*		*$6,394*	*$57,545*	
Subtotal			*$115,890*	*$1,043,010*	
Present Value (2.7%) of Future Cost of Groundwater Sampling Years 2-5, 20, & 22-25			*2.7%*	*$628,586*	

Table C-5 - Cost Estimate for Alternative 5 - ERD, MNA, and LUCs
OU14, Site 90 Feasibility Study, MCAS Cherry Point, North Carolina

Item/Activity	Qty	Unit	Unit Cost	Cost	Notes & Comments
Year 10, 15, 30, 35, 40, 45, 50, 55, & 60 (annual) (50 wells)					
Labor, ODCs, travel	9	event	$15,000	$135,000	Assume 50 wells in performance monitoring program. TBD by Team.
Lab & Data Validation	9	each	$12,027	$108,243	See lab & DV backup sheets
Equipment	9	event	$3,600	$32,400	
Report	9	each	$8,000	$72,000	
Subtotal			*$38,627.02*	*$347,643.18*	
Contingency	*20%*		*$7,725*	*$69,529*	
Project Management	*10%*		*$3,863*	*$34,764*	
G&A	*7%*		*$2,704*	*$24,335*	
Overhead & Profit	*8%*		*$3,090*	*$27,811*	
Subtotal			*$56,009*	*$504,083*	
Present Value (2.7%) of Future Cost of Groundwater Sampling Years 10, 15, 30; and 35, 40, 45… & 60			*2.7%*	*$202,926*	
Total Present Value(2.7%) of All Future Costs			**2.7%**	**$3,982,169**	Y2009 PV calculated for 40-yrs-future-cost using 2.7% Real Discount Rate per Office of Management and Budget (2008) guidance.
TOTAL PV Cost of Alternative 3 - MNA and LUCs			*-30%*	*+50%*	
Using 2.7% Discount Rate for PV of Future Costs	**$6,207,289**		*$4,345,102*	*$9,310,933*	

Other Notes and References:

● The "Real" Discount Rate used to calculate the Present Value cost is 2.7% for a 60-year timeframe per the Office of Management and Budget (OMB), Circular A-94, Appendix C, Revised December 2008, "Discount Rates for Cost Effectiveness, Lease Purchase, and Related Analysis" for Calendar Year 2009, http://www.whitehouse.gov/omb/circulars_a094_a94_appx-c/.

The Real Discount Rates are a forecast of real interest rates from which the inflation premium has been removed and based on the economic assumptions from the December 2010 Budget Baseline. These real rates are to be used for discounting constant-dollar flows, as is often required in cost-effectiveness analysis.

● USEPA. 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* . OSWER Directive 9355.3-01. EPA/540/G-89/004. October.

● USEPA. 2000. *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study* . With the U.S. Army Corps of Engineers. OSWER 9355.0-75. EPA 540-R-00-002. July.

● The information in this cost estimate is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during Baseline Sampling and the Remedial Design phase. This is an order-of-magnitude engineering cost estimate that is expected to be within –30 to +50 percent of the actual project cost (per USEPA, 1988 and 2000).

Alternative 5 - ERD, MNA, and LUCs
Lab Backup
OU14 FS, MCAS Cherry Point

Analysis/Test	Sample Matrix	Field Samples	Field Duplicates	Equipment Rinsate Blanks	Field Blanks	Trip Blanks	Matrix Spike	Matrix Spike Duplicate	Total Number of Solid Samples	Total Billable Solid Samples	Solid Unit Price	Solid Subtotal Cost	Total Number of Liquid Samples	Total Billable Liquid Samples	Liquid Unit Price	Liquid Subtotal Cost	Total Analytical Cost
Implementation																	
Baseline Sampling - Assume 60 existing Surficial Aquifer monitoring wells for COCs and other technology-performance monitoring analyses																	
Groundwater wells																	
TCL VOCs by CLP OLM04.3	GW	60	6	12	3	12	5	5					103	103	$111.71	$11,506.13	$11,506.13
Methane+Ethane+Ethene by RSK-175	GW	60	0	0	0	0	3	3					66	66	$105.18	$6,941.88	$6,941.88
Nitrate+Nitrite+Sulfate by USEPA 300.0	GW	60	0	0	0	0	3	3					66	66	$50.87	$3,357.42	$3,357.42
Sulfide by USEPA 376.1	GW	60	0	0	0	0	3	3					66	66	$35.12	$2,317.92	$2,317.92
Alkalinity by USEPA 310.1	GW	60	0	0	0	0	3	3					66	66	$13.73	$906.18	$906.18
Volatile Fatty Acids (VFAs) (Acetic+Butyric+Pyruvic+Propionic+ and Lactic Acid) by AM23G	GW	60	0	0	0	0	3	3					66	66	$134.90	$8,903.40	$8,903.40
Total Organic Carbon (TOC) by SW-846 9060 Quadruplicate analysis	GW	60	0	0	0	0	3	3					66	66	$33.21	$2,191.86	$2,191.86
Dissolved Iron and Manganese by SW-846 6010B	GW	60	6	0	0	0	4	4					74	74	$35.73	$2,644.02	$2,644.02
IDW - Purged groundwater and decon water																	
Full TCLP (1311/ 8260B+8270C+8151A+ 6010B+7470A+8081A+8082)	Aqueous	1											1	1	$657.00	$657.00	$657.00
Corrosivity as pH by SW-846 9045C	Aqueous	1											1	1	$8.82	$8.82	$8.82
Ignitability by Pensky Martens	Aqueous	1											1	1	$27.30	$27.30	$27.30
																Baseline Subtotal	**$39,461.93**
Additional Baseline -- Assume 30 new wells: 17 new shallow and 13 new deep wells																	
Groundwater wells																	
TCL VOCs	GW	30	3	6	2	6	3	3					53	53	$95.00	$5,035.00	$5,035.00
Methane+Ethane+Ethene	GW	30	0	0	0	0	2	2					34	34	$101.09	$3,437.06	$3,437.06
Nitrate+Nitrite+Sulfate	GW	30	0	0	0	0	2	2					34	34	$48.82	$1,659.88	$1,659.88
Sulfide	GW	30	0	0	0	0	2	2					34	34	$21.91	$744.94	$744.94
Alkalinity	GW	30	0	0	0	0	2	2					34	34	$13.18	$448.12	$448.12
VFAs	GW	30	0	0	0	0	2	2					34	34	$128.57	$4,371.38	$4,371.38
TOC	GW	30	0	0	0	0	2	2					34	34	$33.21	$1,129.14	$1,129.14
Dissolved Iron and Manganese	GW	30	3	0	0	0	2	2					37	37	$28.08	$1,038.96	$1,038.96
IDW - (1) Soil cuttings from new well installations;																	
Full TCLP		2							1	1	$639.00	$639.00	2	2	$657.00	$1,314.00	$1,953.00
Corrosivity	Aqueous	2							1	1	$11.28	$11.28	2	2	$8.45	$16.90	$28.18
Ignitability	& Solid	2							1	1	$26.87	$26.87	2	2	$26.30	$52.60	$79.47
																Additional Baseline Subtotal	**$19,925.13**
																TOTAL IMPLEMENTATION LAB COST	**$59,387.06**
MNA Performance Monitoring / LTM																	
Assume sampling network consists of up to 60 monitoring wells (depending on event)																	
Year 1 & 21 - Quarterly Sampling Event (60 wells)																	
Groundwater wells																	
TCL VOCs	GW	60	6	12	3	12	5	5					103	103	$111.71	$11,506.13	$11,506.13
Methane+Ethane+Ethene	GW	60	0	0	0	0	3	3					66	66	$105.18	$6,941.88	$6,941.88
Nitrate+Nitrite+Sulfate	GW	60	0	0	0	0	3	3					66	66	$50.87	$3,357.42	$3,357.42
Sulfide	GW	60	0	0	0	0	3	3					66	66	$35.12	$2,317.92	$2,317.92
Alkalinity	GW	60	0	0	0	0	3	3					66	66	$13.73	$906.18	$906.18
VFAs	GW	60	0	0	0	0	3	3					66	66	$134.90	$8,903.40	$8,903.40
TOC	GW	60	0	0	0	0	3	3					66	66	$33.21	$2,191.86	$2,191.86
Dissolved Iron and Manganese	GW	60	6	0	0	0	4	4					74	74	$35.73	$2,644.02	$2,644.02
IDW - Purged groundwater and decon water																	
Full TCLP (1311/ 8260B+8270C+8151A+ 6010B+7470A+8081A+8082)	Aqueous	1											1	1	$657.00	$657.00	$657.00
Corrosivity as pH by SW-846 9045C	Aqueous	1											1	1	$8.82	$8.82	$8.82
Ignitability by Pensky Martens	Aqueous	1											1	1	$27.30	$27.30	$27.30
																Subtotal per event	**$39,461.93**
																Total for Years 1+21	**$315,695.44**
Years 2-5, 20, and 22-25 (annual) (60 wells)																	
Groundwater wells																	
TCL VOCs	GW	60	6	12	3	12	5	5					103	103	$111.71	$11,506.13	$11,506.13
Methane+Ethane+Ethene	GW	60	0	0	0	0	3	3					66	66	$105.18	$6,941.88	$6,941.88
Nitrate+Nitrite+Sulfate	GW	60	0	0	0	0	3	3					66	66	$50.87	$3,357.42	$3,357.42
Sulfide	GW	60	0	0	0	0	3	3					66	66	$35.12	$2,317.92	$2,317.92
Alkalinity	GW	60	0	0	0	0	3	3					66	66	$13.73	$906.18	$906.18
VFAs	GW	60	0	0	0	0	3	3					66	66	$134.90	$8,903.40	$8,903.40
TOC	GW	60	0	0	0	0	3	3					66	66	$33.21	$2,191.86	$2,191.86
Dissolved Iron and Manganese	GW	60	6	0	0	0	4	4					74	74	$35.73	$2,644.02	$2,644.02
IDW - Purged groundwater and decon water																	
Full TCLP (1311/ 8260B+8270C+8151A+ 6010B+7470A+8081A+8082)	Aqueous	1											1	1	$657.00	$657.00	$657.00
Corrosivity as pH by SW-846 9045C	Aqueous	1											1	1	$8.82	$8.82	$8.82
Ignitability by Pensky Martens	Aqueous	1											1	1	$27.30	$27.30	$27.30
																Subtotal per event	**$39,461.93**
																Total for Years 2-5 + 20 + 22-25	**$355,157.37**

Alternative 5 - ERD, MNA, and LUCs
Lab Backup
OU14 FS, MCAS Cherry Point

Analysis/Test	Sample Matrix	Field Samples	Field Duplicates	Equipment Rinsate Blanks	Field Blanks	Trip Blanks	Matrix Spike	Matrix Spike Duplicate	Total Number of Solid Samples	Total Billable Solid Samples	Solid Unit Price	Solid Subtotal Cost	Total Number of Liquid Samples	Total Billable Liquid Samples	Liquid Unit Price	Liquid Subtotal Cost	Total Analytical Cost
Year 10, 15, 30, 35, 40, 45, 50, 55, & 60 (annual) (50 wells)																	
Groundwater wells																	
TCL VOCs	GW	50	5	10	2	10	4	4					85	85	$111.71	$9,495.35	$9,495.35
IDW - Purged groundwater and decon water																	
Full TCLP (1311/ 8260B+8270C+8151A+ 6010B+7470A+8081A+8082)	Aqueous	1											1	1	$657.00	$657.00	$657.00
Corrosivity as pH by SW-846 9045C	Aqueous	1											1	1	$8.82	$8.82	$8.82
Ignitability by Pensky Martens	Aqueous	1											1	1	$27.30	$27.30	$27.30
																Subtotal	**$10,188.47**
																Total for Years 10+15+30+35+40+45+50+55+60	**$91,696.23**
																TOTAL FUTURE LAB COST	**$762,549.04**

Full QA/QC for OU14 COCs only. Also+duplicates for metals. MS/MSDs are billable Standard turnaround time

Analysis/Test	Sample Matrix	Field Samples	Field Duplicates	Equipment Rinsate Blanks	Field Blanks	Trip Blanks	Matrix Spike	Matrix Spike Duplicate	Total Number of Solid Samples	Total Billable Solid Samples	Solid Unit Price	Solid Subtotal Cost	Total Number of Liquid Samples	Total Billable Liquid Samples	Liquid Unit Price	Liquid Subtotal Cost	Total Analytical Cost
Implementation																	
Baseline Sampling - Assume 60 existing Surficial Aquifer monitoring wells for COCs and other technology-performance monitoring analyses																	
Groundwater wells																	
TCL VOCs by CLP OLM04.3	GW	60	6	12	3	12	5	5					103	103	$21.63	$2,227.89	$2,227.89
Methane+Ethane+Ethene by RSK-175	GW	60	0	0	0	0	3	3					66	66	$15.14	$999.24	$999.24
Nitrate+Nitrite+Sulfate by USEPA 300.0	GW	60	0	0	0	0	3	3					66	66	$16.22	$1,070.52	$1,070.52
Sulfide by USEPA 376.1	GW	60	0	0	0	0	3	3					66	66	$5.41	$357.06	$357.06
Alkalinity by USEPA 310.1	GW	60	0	0	0	0	3	3					66	66	$5.41	$357.06	$357.06
Volatile Fatty Acids (VFAs) (Acetic+Butyric+Pyruvic+Propionic+ and Lactic Acid) by AM23G	GW	60	0	0	0	0	3	3					66	66	$15.14	$999.24	$999.24
Total Organic Carbon (TOC) by SW-846 9060 Quadruplicate analysis	GW	60	0	0	0	0	3	3					66	66	$8.65	$570.90	$570.90
Dissolved Iron and Manganese by SW-846 6010B	GW	60	6	0	0	0	4	4					74	74	$6.49	$480.26	$480.26
																Baseline Subtotal	**$7,062.17**
Additional Baseline -- Assume 30 new wells: 17 new shallow and 13 new deep wells																	
Groundwater wells																	
TCL VOCs	GW	30	3	6	2	6	3	3					53	53	$21.63	$1,146.39	$1,146.39
Methane+Ethane+Ethene	GW	30	0	0	0	0	2	2					34	34	$15.14	$514.76	$514.76
Nitrate+Nitrite+Sulfate	GW	30	0	0	0	0	2	2					34	34	$16.22	$551.48	$551.48
Sulfide	GW	30	0	0	0	0	2	2					34	34	$5.41	$183.94	$183.94
Alkalinity	GW	30	0	0	0	0	2	2					34	34	$5.41	$183.94	$183.94
VFAs	GW	30	0	0	0	0	2	2					34	34	$15.14	$514.76	$514.76
TOC	GW	30	0	0	0	0	2	2					34	34	$8.65	$294.10	$294.10
Dissolved Iron and Manganese	GW	30	3	0	0	0	2	2					37	37	$6.49	$240.13	$240.13
																Additional Baseline Subtotal	**$3,629.50**
																TOTAL IMPLEMENTATION LAB COST	**$10,691.67**
MNA Performance Monitoring / LTM																	
Assume sampling network consists of up to 60 monitoring wells (depending on event)																	
Year 1 & 21 - Quarterly Sampling Event (60 wells)																	
Groundwater wells																	
TCL VOCs	GW	60	6	12	3	12	5	5					103	103	$21.63	$2,227.89	$2,227.89
Methane+Ethane+Ethene	GW	60	0	0	0	0	3	3					66	66	$15.14	$999.24	$999.24
Nitrate+Nitrite+Sulfate	GW	60	0	0	0	0	3	3					66	66	$16.22	$1,070.52	$1,070.52
Sulfide	GW	60	0	0	0	0	3	3					66	66	$5.41	$357.06	$357.06
Alkalinity	GW	60	0	0	0	0	3	3					66	66	$5.41	$357.06	$357.06
VFAs	GW	60	0	0	0	0	3	3					66	66	$15.14	$999.24	$999.24
TOC	GW	60	0	0	0	0	3	3					66	66	$8.65	$570.90	$570.90
Dissolved Iron and Manganese	GW	60	6	0	0	0	4	4					74	74	$6.49	$480.26	$480.26
																Subtotal per event	**$7,062.17**
																Total for Years 1+21	**$56,497.36**
Years 2-5, 20, and 22-25 (annual) (60 wells)																	
Groundwater wells																	
TCL VOCs	GW	60	6	12	3	12	5	5					103	103	$21.63	$2,227.89	$2,227.89
Methane+Ethane+Ethene	GW	60	0	0	0	0	3	3					66	66	$15.14	$999.24	$999.24
Nitrate+Nitrite+Sulfate	GW	60	0	0	0	0	3	3					66	66	$16.22	$1,070.52	$1,070.52
Sulfide	GW	60	0	0	0	0	3	3					66	66	$5.41	$357.06	$357.06
Alkalinity	GW	60	0	0	0	0	3	3					66	66	$5.41	$357.06	$357.06
VFAs	GW	60	0	0	0	0	3	3					66	66	$15.14	$999.24	$999.24
TOC	GW	60	0	0	0	0	3	3					66	66	$8.65	$570.90	$570.90
Dissolved Iron and Manganese	GW	60	6	0	0	0	4	4					74	74	$6.49	$480.26	$480.26
																Subtotal per event	**$7,062.17**
																Total for Years 2-5 + 20 + 22-25	**$63,559.53**
Year 10, 15, 30, 35, 40, 45, 50, 55, & 60 (annual) (50 wells)																	
Groundwater wells																	
TCL VOCs	GW	50	5	10	2	10	4	4					85	85	$21.63	$1,838.55	$1,838.55
																Subtotal	**$1,838.55**
																Total for Years 10+15+30+35+40+45+50+55+60	**$16,546.95**
																TOTAL FUTURE LAB COST	**$136,603.84**

EOS Remediation, Inc.

Appendix C
Alternative 5 - ERD EOS® Dosage

EOS® Dosage Calculation Per Injection Well Based on Residual Saturation

Beta Version 1.3 (Modified by CH2M HILL)

Date: 12/9/2008
Site Name: OU14, Site 90
Location: MCAS Cherry Point
Project No.: 361935

Design Inputs

Radius of Injection	15	ft	4.6	m	*radius of injection*
Width of proposed barrier perpendicular to groundwater flow	30	ft	9.1	m	*diameter of injection*
Thickness of proposed barrier	30	ft	9.1	m	*diameter of injection*
Depth of proposed barrier (treatment thickness / injection well screen length)	20	ft	6.1	m	*Continuous wrap 0.020-slot 4-in ID screen (20-ft 0.020-slot, continuous-wrap injection screen)*
Volume of treatment zone	14,137	ft3	509.7	m3	
Mobile Porosity**	0.1				

*** Mobile porosity is empirically based, and is functionally defined as the volume of injectate required to achieve a specific radius of injection divided by the total volume of the aquifer impacted by the injectate (i.e., the volume percentage of the connected preferential flow paths in the aquifer through which the injectate will actually travel/flow from the well during the injection).*

Soil Characteristics

Nominal soil type		silty sand		*OU14 site-specific*
Density of soil		115	lbs / ft3	*OU14 RI value (1.85 g/cm3)*
Soil to be treated		1,625,774	lbs	
Aquifer "Sorption" Capacity (empirical value)1	**Option 1**	0.001	lbs EOS® / lbs soil	*(providing range of empirical values)*
	Option 2	0.002	lbs EOS® / lbs soil	

-Fine sand with some clay 0.001 to 0.002 lbs EOS® / lbs soil

-Sand with higher silt/clay content 0..002 to 0.004 lbs EOS® / lbs soil

1Default values provided based on laboratory studies completed by NCSU

Option 1				
	EOS® Concentrate Requirement for 1 Injection Point (0.001 lb EOS® / lb soil)	1,626	pounds	*Drum contains 52.5 gallons of EOS concentrate*
		200.71	gallons	*EOS 598 is 60% Oil by wt (~8.1 lbs/gal or ~425 lbs/drum)*
		3.83	drums	*EOS 598 contains 4% Lactate*
	Cost per drum (including shipping)	$ 922	*large quantity*	*Note: EOS® is sold by whole drum quantities, only*
	Estimated Cost of 4 drums of EOS® Concentrate (including shipping)	$ 3,688		

Dosage Per Injection Well

Number of injection points evaluated	1	points				
EOS® Concentrate injected per point	1,626	pounds	200.7	gallons	3.8	drums
Estimated Fractional Cost of EOS® Concentrate per point	$3,526.97	*fractional based on pounds calculated above*				
Injection point diameter	30	feet				
Mobile Pore volume per injection point (using mobile porosity above)	10,575	gallons	*Mobile porosity of 0.1 (see above) used in calculation of 'pore volume'*			
Displacement flush pore volumes	1	typical values 1 to 1.25				
Displacement flush water (mixture water) volume per point	10,374	gallons	*Subtract out volume of EOS concentrate*			
Total EOS® Injection Mixture volume per injection point	10,575	gallons	*Total EOS® injection mixture followed (chased) by flush water, or EOS® injection mixture combined with flush water and injected together.*			

Volume does not include any sodium bicarbonate for pH buffering. Nominal volume added ~5lbs per well.

Option 2				
	EOS® Concentrate Requirement for 1 Injection Point (0.002 lb EOS® / lb soil)	3,252	pounds	*Drum contains 52.5 gallons of EOS concentrate*
		401.43	gallons	*EOS 598 is 60% Oil by wt (~8.1 lbs/gal or ~425 lbs/drum)*
		7.65	drums	*EOS 598 contains 4% Lactate*
	Cost per drum (including shipping)	$ 922		*Note: EOS® is sold by whole drum quantities, only*
	Estimated Cost of 8 drums of EOS® Concentrate (including shipping)	$ 7,376		

Dosage Per Injection Well

Number of injection points evaluated	1	points				
EOS® Concentrate injected per point	3,252	pounds	401.4	gallons	7.7	drums
Estimated Fractional Cost of EOS® Concentrate per point	$7,053.95	*fractional based on pounds calculated above*				
Injection point diameter	30	feet				
Mobile Pore volume per injection point (using mobile porosity above)	10,575	gallons	*Mobile porosity of 0.1 (see above) used in calculation of 'pore volume'*			
Displacement flush pore volumes	1	typical values 1 to 1.25				
Displacement flush water (mixture water) volume per point	10,173	gallons	*Subtract out volume of EOS concentrate*			
Total EOS® Injection Mixture volume per injection point	10,575	gallons	*Total EOS® injection mixture*			

Volume does not include any sodium bicarbonate for pH buffering. Nominal volume added ~5lbs per well.

**New AquaBupH™ substrate (40% oil EOS; pH 9) provides buffering at 0.25 kg CaCO3 equiv./kg AquaBupH™*

†Exclusive license agreement with Solutions-IES

††U.S. Patent # 6,398,960 and several international patents pending

†††EOS® is a registered trademark of Solutions-IES